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PART I.

Original Contributions.

THE ACTION OF MYOTICS AND MYDRIATICS ON THE ACCOMMODATION.

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IN a preceding communication (*see* p. 130) we referred to the action of eserine and pilocarpine on the pupil and on the accommodation. In this we refer to the action of homatropine and of homatropine and cocaine, and to the action of eserine on eyes to which these drugs had already been applied.

Method of Investigation.—The solutions used were—

A 2 p. c. solution of homatropine in castor oil.

A 2 p. c. solution of homatropine and of cocaine in castor oil.

A 1 p. c. solution of eserine in water.

The application has in all cases consisted of the deposition of a few drops of the solution inside the lower eyelid. The estimation of the size of the pupil has been made with a pupillometer, the same amount of light being

thrown into the eye during each measurement. The estimation of the position of the far and near points has been made by means of a "slide optometer" (constructed for us by Messrs. Pickard and Curry), similar to that now in use in Utrecht. Measurements have been made in one meridian only (vertical).

In order to bring the points within measurable distance the eyes observed were always rendered myopic by convex lenses. The lenses were always placed very close to the eye, so that the nodal point was not materially altered in position, and consequently the ranges of accommodation given represent very nearly the true range.

I. *The Action of Homatropine.*

The following six tables show the effect produced on the pupil and accommodation apparatus by the single application of a 2 p. c. solution of homatropine in castor oil:—

CASE I.—A. D., æt. 25. *Right Eye.* $V. = \frac{6}{6}$ partly,

$$\bar{c} + 0.75 \text{ D. cyl. axis vert.} = \frac{6}{6}.$$

Time.	Pupil.	Near point.
<i>Before application ...</i>	5 mm.	15 cm.
<i>After application—</i>		
5 minutes	5 "	16 "
10 "	5 "	16 "
15 "	5.5 "	19 "
20 "	6.5 "	21 "
25 "	7 "	22 "
30 "	7.5 "	25 "
35 "	7.5 "	29 "
40 "	8 "	36 "
45 "	8 "	54 "
50 "	8 "	74 "
55 "	8 "	105 "
60 "	8 "	120 "
65 "	8 "	210 "
6 hours	..	Almost in original position.
10 hours	..	Recovered completely.

In this case the position of the far point was not estimated throughout. The position has therefore in our calculations been assumed to be invariable.

In this case the application of homatropine caused—

(1.) A dilatation of the pupil, which began at the 15th minute, and reached its maximum at the 40th.

(2.) A recession of the near point, which began at the 5th minute, and reached its maximum at the 65th, and disappeared in 10 hours. This recession at its maximum was equivalent to 6.19 D.

(3.) A diminution of the range of accommodation, which began at the 5th minute, reached its maximum at the 65th minute, and disappeared in 10 hours. This decrease at its maximum amounted to 6.19 D., that is, 0.93 of the normal range (6.67 D.), so that the total range was then 0.48 D.

CASE II.—R. D., æt. 23. *Left Eye*. $V. = \frac{6}{9} \bar{c} \frac{-0.25 \text{ D.}}{-0.5 \text{ D. cyl. vert.}} = \frac{6}{6}$.

A +0.75 D. Spherical Lens was worn during this Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application ...</i>	4 mm.	10 cm.	100 cm.
<i>After application—</i>			
5 minutes	4 "	11 "	100 "
10 "	4 "	15 "	85 "
15 "	4 "	21 "	90 "
20 "	4.5 "	20 "	90 "
25 "	5.5 "	25 "	85 "
30 "	6 "	29 "	75 "
35 "	6.5 "	35 "	75 "
40 "	6.5 "	25 "	88 "
45 "	7.5 "	35 "	75 "
50 "	8 "	37 "	78 "
55 "	8 "	47 "	75 "
60 "	8 "	45 "	77 "
65 "	8 "	52 "	71 "
70 "	9 "	43 "	73 "
75 "	9 "	50 "	68 "
80 "	"	50 "	72 "
85 "	"	49 "	59 "
90 "	"	50 "	65 "
95 "	"	50 "	68 "
100 "	9 "	52 "	75 "
150 "	9 "	34 "	80 "
165 "	9 "	36 "	
4 hours	"	28 "	
6 "	"	18 "	
8 "	"	13 "	
10.5 "	"	10 "	
36 "	normal		

In this case the application of homatropine caused—

(1.) A dilatation of the pupil, which began at the 20th minute, reached its maximum at the 70th minute, and disappeared in 36 hours.

(2.) A recession of the near point, which began at the 5th minute, reached its maximum at the 65th minute, and disappeared in 10·5 hours. The maximum recession was equivalent to 8·08 D.

(3.) An approximation of the far point, which began at the 10th minute, reached its maximum at the 85th, and was then equivalent to 0·69 D.

(4.) A diminution in the range of accommodation, which began at the 5th minute, reached its maximum at the 85th minute, and disappeared in 10·5 hours. This decrease at its maximum amounted to 8·65 D.; that is, 0·96 of the normal range (9 D.), so that the total range was then 0·35 D.

CASE III.—C. P., æt. 20. *Left Eye.* $V. = \frac{6}{6}$. Hm. 0·75 D.

A +1·75 D. Spherical Lens was worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application....</i>	3 mm.	10 cm.	98 cm.
<i>After application—</i>			
5 minutes	3 "	11 "	100 "
10 "	3·5 "	11 "	100 "
15 "	6 "	15 "	78 "
20 "	7 "	17 "	77 "
25 "	7 "	18 "	78 "
30 "	7·5 "	29 "	76 "
35 "	7·5 "	30 "	87 "
40 "	7·5 "	34 "	86 "
45 "	7·5 "	41 "	85 "
50 "	7·5 "	49 "	75 "
55 "	7·5 "	50 "	74 "
60 "	7·5 "	47 "	73 "
70 "	7·5 "	45 "	66 "
80 "	8 "	53 "	74 "
90 "	8 "	40 "	71 "
100 "	8 "	44 "	81 "
110 "	8 "	37 "	87 "
120 "	8 "	36 "	90 "
130 "	8 "	34 "	93 "
140 "	8 "	29 "	97 "
12 hours	..	normal	
36 "	normal		

In this case the application of homatropine caused—

(1.) A dilatation of the pupil, which began at the 10th minute, reached its maximum at the 80th minute, and disappeared in 36 hours.

(2.) A recession of the near point, which began at the 5th minute, reached its maximum at the 80th minute, and disappeared in 12 hours. This recession at its maximum was equivalent to 8.11 D.

(3.) An approximation of the far point, which began at the 15th minute, and reached its maximum at the 70th minute; it was then equivalent to 0.49 D.

(4.) A diminution in the range of accommodation, which began at the 5th minute, reached its maximum at the 80th minute, and disappeared in 12 hours. This decrease at its maximum amounted to 8.44 D.; that is, 0.914 of the normal range (8.98 D.), so that the total range was then 0.54 D.

CASE IV.—P., æt. 21. *Left Eye.* $V. = \frac{6}{6}$. Emmetropic.

A +2 D. Spherical Lens worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application....</i>	4 mm.	12 cm.	33 cm.
<i>After application—</i>			
5 minutes	4.5 „	13 „	33 „
10 „	6.5 „	16 „	30 „
15 „	8 „	17 „	44 „
20 „	8 „	17 „	48 „
25 „	8.5 „	18 „	50 „
30 „	9 „	18 „	50 „
35 „	9 „	23 „	48 „
40 „	9 „	23 „	52 „
45 „	9 „	29 „	53 „
50 „	9 „	32 „	50 „
55 „	9 „	33 „	61 „
60 „	9 „	35 „	60 „
65 „	9 „	40 „	65 „
70 „	9 „	32 „	62 „
75 „	9 „	36 „	66 „
80 „	9 „	39 „	73 „
85 „	9 „	39 „	63 „
90 „	9 „	36 „	66 „
95 „	9 „	38 „	63 „
100 „	9 „	39 „	76 „

CASE IV—*continued.*

Time.	Pupil.	Near point.	Far point.
<i>After application—</i>			
105 minutes	9 mm.	37 cm.	65 cm.
5 hours	..	21 "	
7 "	..	13 "	
9 "	..	12 "	
19 "	normal		

In this case the application of the homatropine caused—

(1.) A dilatation of the pupil, which began at the 5th minute, reached its maximum at the 30th minute, and disappeared in 19 hours.

(2.) A recession of the near point, which began at the 5th minute, reached its maximum at the 65th minute, and disappeared in 9 hours. The maximum recession was equivalent to 5.83 D.

(3.) A recession of the far point, which began at the 15th minute, reached its maximum at the 100th minute, and was then equivalent to 1.72 D.

(4.) A diminution in the range of accommodation, which began at the 5th minute, reached its maximum at the 65th minute, and disappeared in 9 hours. This decrease at its maximum amounted to 4.34 D.; that is, 0.81 of the normal range (5.3 D.), so that the total range was then 0.96 D.

CASE V.—A., æt. 23. *Left Eye.* $V. = \frac{6}{6}$. Hm. 0.5 D.

A +2 D. Spherical Lens was worn during this Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application...</i>	2.5 mm.	12 cm.	67 cm.
<i>After application—</i>			
5 minutes	2.5 "	13 "	90 "
10 "	2.5 "	15 "	91 "
15 "	3 "	15 "	100 "
20 "	3 "	18 "	89 "
25 "	4.5 "	27 "	100 "
30 "	5 "	40 "	102 "
35 "	5.5 "	35 "	91 "
40 "	5.5 "	37 "	87 "
45 "	6 "	35 "	90 "
50 "	6.5 "	33 "	75 "
55 "	6.5 "	33 "	80 "
60 "	6.5 "	30 "	82 "
65 "	7 "	29 "	84 "
70 "	6.5 "	31 "	99 "
80 "	6.5 "	29 "	91 "
90 "	7.5 "	29 "	92 "
100 "	7.5 "	29 "	87 "
5 hours	..	12 "	
24 "	normal		

In this case the application of homatropine caused—

(1.) A dilatation of the pupil, which began at the 15th minute, reached its maximum at the 90th minute, and disappeared in 24 hours.

(2.) A recession of the near point, which began at the 5th minute, reached its maximum at the 30th minute, and disappeared in 5 hours. The maximum recession was equivalent to 5.83 D.

(3.) A recession of the far point, which began at the 5th minute, and reached its maximum at the 30th minute, and was then equivalent to 0.51 D.

(4.) A diminution of the range of accommodation, which began at the 5th minute, reached its maximum at the 30th minute, and disappeared in 5 hours. This diminution at its maximum amounted to 5.32 D.; that is, 0.78 of

the normal range (6.84 D.), so that the total range was then 1.52 D.

CASE VI.—S., æt. 22. *Left Eye.* $V. = \frac{6}{12} \bar{c} - 0.75 \text{ D. } \frac{6}{6}.$

A +0.5 D. Spherical Lens was worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application....</i>	3.5 mm.	14 cm.	90 cm.
<i>After application—</i>			
5 minutes	3.5 "	14 "	85 "
10 "	3.5 "	14 "	89 "
15 "	4.5 "	16 "	92 "
20 "	5 "	18 "	91 "
25 "	6.5 "	19 "	89 "
30 "	6 "	23 "	90 "
35 "	6.5 "	23 "	89 "
40 "	7 "	26 "	94 "
45 "	7 "	29 "	99 "
50 "	7.5 "	26 "	98 "
55 "	7.5 "	28 "	93 "
60 "	7.5 "	28 "	100 "
65 "	7.5 "	31 "	100 "
70 "	7.5 "	29 "	100 "
75 "	7.5 "	26 "	100 "
80 "	7.5 "	26 "	96 "
85 "	7.5 "	26 "	97 "
90 "	7.5 "	25 "	100 "
105 "	7.5 "	26 "	100 "
3 hours	..	26 "	
4 "	..	19 "	
5 "	..	17 "	
6 "	..	14 "	
15 "	normal		

In this case the application of homatropine caused—

(1.) A dilatation of the pupil, which began at the 15th minute, reached its maximum at the 50th minute, and disappeared in 15 hours.

(2.) A recession of the near point, which began at the 15th minute, reached its maximum at the 65th minute, and disappeared in 6 hours. The maximum recession was equivalent to 3.92 D.

(3.) A variability in the position of the far point; the

maximum approximation occurred at the 5th minute, and was equivalent to 0.07 D. The maximum recession occurred at the 60th minute, and was equivalent to 0.11 D.

(4.) A diminution of the range of accommodation, which began at the 5th minute, reached its maximum at the 65th minute, and disappeared in 6 hours. This decrease at its maximum amounted to 3.81 D.; that is, 0.63 of the normal range (6.03 D.), so that the total range was then 23.22 D.

Summary.—It seems, then, that the application of homatropine caused—

(1.) A dilatation of the pupil, which began from the 5th to the 20th minute, reached its maximum between the 30th and 90th minutes, and disappeared in from 15 to 36 hours.

(2.) A recession of the near point, which began between the 5th and 15th minutes, reached its maximum between the 30th and 80th minutes, and disappeared in from 6 to 12 hours. The maximum recession was equivalent to from 3.92 D. to 8.11 D.

(3.) A variability in the position of the far point. The maximum recession occurred between the 30th and 100th minutes, and was equivalent to from 0.11 D. to 1.72 D. The maximum approximation occurred between the 5th and 85th minutes, and was equivalent to from 0.67 D. to 0.69 D.

(4.) A diminution of the range of accommodation, which began at the 5th minute, reached its maximum between the 30th and 85th minutes, and disappeared in from 5 to 10.5 hours. This diminution at its maximum was equivalent to from 3.81 D. to 8.65 D., or from 0.63 to 0.96 of the normal range (5.3 D. to 9 D.). The total range at the time of maximum diminution was from 0.35 D. to 2.22 D.

Taking averages, it seems that the application caused—

(1.) A dilatation of the pupil, which began at the 13.33 minute, reached its maximum at the 60th minute, and disappeared in 21.67 hours.

(2.) A recession of the near point, which began at the 6.67 minute, reached its maximum at the 61.67 minute, and disappeared in 8.75 hours. The maximum recession was equivalent to 6.33 D.

(3.) A variability in the position of the far point. The maximum recession occurred at the 63.33 minute, and was equivalent to 0.78 D. The maximum approximation occurred at the 53.33 minute, and was equivalent to 0.42 D.

(4.) A diminution of the range of accommodation, which began at the 5th minute, reached its maximum at the 65th minute, and disappeared in 8.75 hours. The diminution at its maximum was equivalent to 6.12 D.; that is, 0.86 of the normal range (7.14 D.), so that the total range was then 1.01 D. (*See Chart I.*)

Remarks.—The variability in the position of the far point demands explanation. The slight approximation which often occurred seemed to be caused by the dilatation of the pupil, since the application of a diaphragm with a small aperture to the eye caused the far point to recede materially. The recession seemed to be caused by the paralysis of the ciliary muscle, and the consequent transference of latent into manifest hypermetropia.

II. *The Action of Homatropine + Cocaine.*

The following six tables show the action on the pupil and accommodation of a single application of a solution of homatropine (2 p. c.) + cocaine (2 p. c.) in castor oil.

CASE I.—*Right Eye.* $V. = \frac{6}{5}$ Emmetropic. A + 2 D. Spherical
Lens worn during Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application</i>	4 mm.	12 cm.	34 cm.
<i>After application—</i>			
5 minutes	5 "	13 "	33 "
10 "	9 "	17 "	34 "
15 "	10 "	20 "	34 "
20 "	10 "	24 "	47 "
25 "	10 "	29 "	58 "
30 "	10 "	34 "	59 " $V\bar{c} + 0.5 D. = \frac{6}{6}$
35 "	10 "	40 "	63 "
40 "	10 "	43 "	65 "
45 "	10 "	45 "	69 "
50 "	10 "	50 "	68 "
55 "	10 "	53 "	72 " $V\bar{c} + 0.75 D. = \frac{6}{6}$
60 "	10 "	56 "	75 "
65 "	10 "	62 "	84 " $V\bar{c} + 1 D. = \frac{6}{6}$
70 "	10 "	50 "	89 "
75 "	10 "	56 "	86 "
80 "	10 "	56 "	91 "
85 "	10 "	53 "	90 "
90 "	10 "	49 "	87 "
95 "	10 "	51 "	88 "
100 "	10 "	51 "	86 "
105 "	10 "	50 "	87 "
19 hours	..	normal	85 "
48 "	normal		

In this case the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil, which began at the 5th minute, reached its maximum at the 15th, and disappeared in 48 hours.

(2.) A recession of the near point, which began at the 5th minute, reached its maximum at the 65th minute, and disappeared in 19 hours. The maximum recession was equivalent to 6.72 D.

(3.) A recession of the far point, which began at the 13th minute, and reached its maximum at the 75th minute. The maximum recession was equivalent to 1.84 D.

(4.) A diminution of the range of accommodation, which began at the 5th minute, reached its maximum at the 65th minute, and disappeared in 19 hours. This decrease at its maximum amounted to 4.9 D., that is, 0.91 of the normal range (5.39 D.), so that the total range was then 0.49 D.

CASE II.—A., æt. 23. *Right Eye.* $V^c \frac{+ 3 \text{ D sph.}}{+ 0.75 \text{ D cyl. } 70^\circ \text{ out}}$
 $= \frac{6}{6}$. A + 5 D. Spherical Lens worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application...</i>	2.5 mm.	14 cm.	61 cm.
<i>After application—</i>			
5 minutes	2.5 "	16 "	51 "
10 "	3 "	24 "	68 "
15 "	4 "	35 "	80 "
20 "	5.5 "	50 "	100 "
25 "	6.5 "	58 "	103 "
30 "	7.5 "	75 "	105 "
35 "	7.5 "	62 "	101 "
40 "	8 "	58 "	102 "
45 "	9 "	66 "	100 "
50 "	9 "	55 "	107 "
55 "	9 "	49 "	103 "
60 "	9 "	51 "	95 "
65 "	9 "	53 "	100 "
70 "	9 "	44 "	95 "
80 "	9 "	49 "	102 "
90 "	9 "	43 "	87 "
100 "	9 "	40 "	90 "
48 hours	normal	normal	

In this case the application of homatropine + cocaine caused—

(1.) Dilatation of the pupil, which began at the 10th minute, reached its maximum at the 45th minute, and disappeared in 48 hours.

(2.) A recession of the near point, which began at the 5th minute, reached its maximum at the 30th minute, and disappeared in 48 hours. The maximum recession was equivalent to 5.81 D.

(3.) A recession of the far point, which began at the 10th minute, and virtually reached its maximum at the 30th minute (the actual maximum was reached at the 50th minute). The maximum recession was equivalent to 0·71 D.

(4.) A diminution of the range of accommodation, which began at the 5th minute, reached its maximum at the 30th minute, and disappeared in 48 hours. This decrease at its maximum amounted to 5·12 D., that is, 0·91 D. of the normal range (5·5 D.), so that the total range was then 0·38 D.

CASE III.—S., æt. 22. *Right Eye.* $\frac{6}{24}$ c 1·5 D. = $\frac{6}{18}$ partly.

Time.	Pupil.	Near point.	Far point.
<i>Before application . . .</i>	3·5 mm.	13 cm.	58 cm.
<i>After application—</i>			
5 minutes	3·5 "	13 "	50 "
10 "	3·5 "	14 "	48 "
15 "	4·5 "	17 "	47 "
20 "	5 "	21 "	58 "
25 "	6·5 "	23 "	59 "
30 "	6·5 "	26 "	57 "
35 "	7 "	29 "	63 "
40 "	7·5 "	29 "	55 "
45 "	7·5 "	28 "	58 "
50 "	8 "	30 "	56 "
55 "	8 "	36 "	65 "
60 "	8 "	31 "	55 "
65 "	8 "	29 "	60 "
70 "	8 "	30 "	60 "
75 "	8 "	31 "	62 "
80 "	8 "	29 "	64 "
85 "	8 "	29 "	69 "
90 "	8 "	30 "	72 "
105 "	8 "	29 "	72 "
3 hours	..	27 "	68 "
4 "	..	19 "	
5 "	..	normal	
15 "	normal		

In this case the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil, which began at the 15th

minute, reached its maximum at the 50th minute, and disappeared in 15 hours.

(2.) A recession of the near point, which began at the 10th minute, reached its maximum at the 55th minute, and disappeared in less than 15 hours. The maximum recession was equivalent to 4.91 D.

(3.) A variability in the position of the far point, the maximum approximation being reached at the 15th minute, and the maximum recession at the 90th minute. The maximum approximation was equivalent to 0.41 D., and the maximum recession to 0.74 D.

(4.) A diminution of the range of accommodation, which began at the 5th minute, reached its maximum at the 55th minute, and disappeared in less than 15 hours. The decrease at its maximum amounted to 4.73 D., that is, 0.79 of the normal range (5.97 D.), so that the total range was then 1.24 D.

CASE IV.—C. P., æt. 20. *Right Eye*. $V. = \frac{6}{6}$. Hm. 1 D.

A +2 D. Spherical Lens worn during Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application...</i>	3 mm.	11 cm.	98 cm.
<i>After application—</i>			
5 minutes	4.5 "	12 "	92 "
10 "	8 "	13 "	91 "
15 "	9 "	17 "	96 "
20 "	10 "	23 "	85 "
25 "	10 "	31 "	83 "
30 "	10 "	41 "	89 "
35 "	10 "	50 "	91 "
40 "	10 "	50 "	88 "
45 "	10 "	49 "	94 "
50 "	10 "	52 "	82 "
60 "	10 "	51 "	99 "
70 "	9 "	56 "	96 "
80 "	9.5 "	49 "	94 "
90 "	9 "	49 "	100 "
100 "	9 "	50 "	107 "
110 "	9 "	44 "	107 "
120 "	9 "	43 "	112 "
130 "	9 "	41 "	109 "
140 "	9 "		
24 hours	normal	normal	

In this case the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil, which began at the 5th minute, reached its maximum at the 20th minute, and disappeared in 24 hours.

(2.) A recession of the near point, which began at the 5th minute, reached its maximum at the 70th minute, and disappeared in 24 hours. The maximum recession was equivalent to 7.31 D.

(3.) A variability in the position of the far point, the maximum approximation being reached at the 50th minute, and the maximum recession at the 120th minute. The maximum approximation was equivalent to 0.2 D., and the maximum recession to 0.13 D.

(4.) A diminution of the range of accommodation, which began at the 5th minute, reached its maximum at the 50th minute, and disappeared in 24 hours. The decrease at its maximum amounted to 7.73 D., that is, 0.91 of the normal range (8.07 D.), so that the total range was then 0.7 D.

CASE V.—J. W. B., æt. 24. *Left Eye.* $V. = \frac{6}{6}$. Under

Homatropine. $V. = \frac{6}{9}$, $\bar{c} = .25$ D. cyl. $= \frac{6}{5}$. A + 1.5 D.

Spherical Lens was worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application....</i>	4.5 mm.	8 cm.	50 cm.
<i>After application—</i>			
5 minutes	4.5 "	8 "	50 "
10 "	5.5 "	13 "	50 "
15 "	9 "	18 "	57 "
20 "	9.5 "	24 "	52 "
25 "	10 "	23 "	52 "
30 "	10 "	27 "	56 "
35 "	10 "	32 "	57 "
40 "	10 "	32 "	57 "
45 "	10 "	33 "	59 "
50 "	10 "	36 "	60 "
55 "	10 "	35 "	56 "

CASE V—*continued*.

Time.	Pupil.	Near point.	Far point.
<i>After application—</i>			
60 minutes	10 mm.	37 cm.	58 cm.
65 "	10 "	37 "	57 "
70 "	10 "	36 "	57 "
80 "	10 "	37 "	59 "
4 hours	10 "	28 "	
8 "	10 "	22 "	
12 "	10 "	9 "	
24 "	6 "	normal	
32 "	6 " (active)		
48 "	normal		

In this case the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil, which began at the 10th minute, reached its maximum at the 25th, and disappeared in 48 hours.

(2.) A recession of the near point, which began in 10 minutes, reached its maximum at the 60th minute, and disappeared in 24 hours. The maximum recession was equivalent to 9·8 D.

(3.) A recession of the far point, which began at the 15th minute, and reached its maximum at the 50th minute. The maximum recession was equivalent to 0·33 D.

(4.) A diminution of the range of accommodation, which began at the 10th minute, reached its maximum at the 65th minute, and disappeared in 24 hours. The decrease at its maximum amounted to 9·55 D., that is, 0·91 of the normal range (10·5 D.), so that the total range was then 0·95 D.

CASE VI.—R. D., æt. 23. — *Right Eye.* $V. = \frac{6}{18} \bar{c}$

$$\frac{-0.5 \text{ D.}}{-0.5 \text{ D. cyl. axis vert.}} = \frac{6}{5} \quad A + 0.5 \text{ D. Spherical Lens was}$$

worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application....</i>	4 mm.	11 cm.	90 cm.
<i>After application—</i>			
5 minutes.....	4 "	12 "	85 "
10 ".....	4 "	12 "	89 "
15 ".....	8 "	17 "	65 "
20 ".....	9 "	50 "	70 "
25 ".....	10 "	45 "	70 "
30 ".....	10 "	40 "	70 "
35 ".....	10 "	35 "	75 "
40 ".....	10 "	40 "	68 "
45 ".....	10 "	35 "	70 "
50 ".....	10 "	35 "	62 "
55 ".....	10 "	45 "	70 "
60 ".....	10 "	46 "	70 "
65 ".....	10 "	48 "	68 "
70 ".....	10 "	50 "	62 "
75 ".....	10 "	47 "	63 "
80 ".....	10 "	50 "	70 "
85 ".....	10 "	50 "	56 "
90 ".....	10 "	55 "	61 "
95 ".....	10 "	50 "	57 "
105 ".....	10 "	50 "	65 "
155 ".....	10 "	41 "	68 "
170 ".....	10 "	46 "	67 "
4 hours.....	..	35 "	
10.5 ".....	..	17 "	
24 ".....	normal	normal	

In this case the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil, which began at the 15th minute, reached its maximum at the 25th minute, and disappeared in 24 hours.

(2.) A recession of the near point, which began at the 5th minute, reached its maximum at the 90th minute, and disappeared in 24 hours. The maximum recession was equivalent to 7.27 D.

(3.) An approximation of the far point, which began at the 5th minute, and reached its maximum at the 85th

minute. The maximum approximation was equivalent to 0.67 D.

(4.) A diminution in the range of accommodation, which began at the 5th minute, reached its maximum at the 90th minute, and disappeared in 24 hours. The decrease at its maximum amounted to 7.8 D., that is, 0.98 of the normal range (7.98 D.), so that the total range was then 0.18 D.

Summary.—It seems then that the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil, which began between the 5th and 15th minutes, reached its maximum between the 15th and 50th minutes, and disappeared in from 15 to 48 hours.

(2.) A recession of the near point, which began between the 5th and 10th minutes, reached its maximum between the 30th and 90th minutes, and disappeared in from 15—48 hours. The maximum approximation was equivalent to from 4.91 D. to 9.8 D.

(3.) A variability in the position of the far point. The maximum approximation occurred between the 15th and 85th minutes, and was equivalent to from 0.2 D. to 0.67 D. The maximum recession occurred between the 50th and 120th minutes, and was equivalent to from 0.13 D. to 1.84 D.

(4.) A diminution of the range of accommodation, which began between the 5th and 10th minutes, reached its maximum between the 30th and 90th minutes, and disappeared in from 15—48 hours. The maximum diminution was from 4.73 D. to 9.55 D., that is, 0.79 to 0.98 of the normal range (5.39 to 10.5 D.), so that the total range was then 0.18 D. to 1.24 D.

Taking averages, it seems that the application caused—

(1.) A dilatation of the pupil, which began at the 10th minute, reached its maximum at the 30th minute, and disappeared in 34.5 hours.

(2.) A recession of the near point, which began at the 6·67 minute, reached its maximum at the 61·67 minute, and disappeared in 25·67 hours. The maximum recession was equivalent to 6·97 D.

(3.) A variability in the position of the far point. The maximum approximation occurred at the 50th minute, and was equivalent to 0·43 D. The maximum recession occurred at the 77th minute, and was equivalent to 0·75 D.

(4.) A diminution of the range of accommodation, which began at the 5·83 minute, reached its maximum at the 59·17 minute, and disappeared in 25·67 hours. The maximum diminution was equivalent to 6·58 D., that is, 0·91 D. of the normal range (7·23 D.), so that the total range was then 0·66 D. (*See Chart II.*)

Comparison of the Actions of Homatropine and of Homatropine + Cocaine.

A survey of the table on page 238 shows—

(1.) That homatropine + cocaine dilates the pupil more rapidly than homatropine alone, and that the effect lasts longer.

(2.) That homatropine + cocaine alters the position of the far and near points in about the same time as homatropine alone. The effect on the near point lasts much longer. The amount of action is somewhat greater in the case of homatropine with cocaine.

(3.) That homatropine + cocaine causes a slightly more rapid and a greater diminution of the range of accommodation than homatropine alone, the accommodation being nearly reduced to *nil* by their influence.

Practical Deduction.—That for ophthalmoscopic and similar purposes the application of homatropine + cocaine to paralyse the sphincter pupillæ and ciliary muscle produces better results than those produced by homatropine alone, and in a shorter period of time.

Table showing the Action of Homatropine and of Homatropine + Cocaine.

		Dilatation of pupil.	Recession of near point.	Variability in position of far point.		Diminution of range of accommodation.
				Approximate.	Recession.	
Time of commencement of action.	Homatropine	13-33 mins.	6-67 mins.	..	..	5 mins.
	Homatropine + cocaine	10 "	6-67 "	..	..	5-83 mins.
Time of maximum action.	Homatropine	60 "	61-67 "	53-33 mins.	63-33 mins.	65 mins.
	Homatropine + cocaine	30 "	61-67 "	50 "	77 "	59-17 mins.
Time of cessation of action.	Homatropine	21-67 hours	8-75 hours	..	..	8-75 hours.
	Homatropine + cocaine	34-5 "	25-67 "	..	..	25-67 "
Amount of maximum action.	Homatropine	..	6-33 D.	0-42 D.	0-78 D.	6-12 D. or 0-86 of the normal range 7-14 D. so that the total range was then 1-01 D.
	Homatropine + cocaine	..	6-97 D.	0-42 D.	0-75 D.	6-58 D. or 0-91 of the normal range 7-23 D. so that the total range was 0-66 D.

III. *The Action of Homatropine with Eserine.*CASE I.—P., æt. . *Right Eye.* $V. = \frac{6}{5}$. Emmetropic. A

+2 D. Spherical Lens worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application</i>	4 mm.	13 cm.	42 cm.
<i>After application—</i>			
5 minutes	4 "	13 "	39 "
10 "	5 "	16 "	42 "
15 "	7·5 "	16 "	47 "
20 "	7·5 "	19 "	45 "
25 "	8·5 "	17 "	44 "
30 "	9 "	22 "	49 "
35 "	9 "	26 "	47 "
40 "	9·5 "	28 "	47 "
45 "	9·5 "	26 "	48 "
50 "	9·5 "	26 "	50 "
55 "	9·5 "	31 "	51 "
60 "	9·5 "	30 "	51 "
65 "	9·5 "	35 "	56 "
70 "	9·5 "	28 "	48 "
75 "	9·5 "	29 "	49 "
80 " (eserine applied)	9·5 "	30 "	53 "
85 "	9·5 "	14 "	16 "
90 "	7 "	12 "	12 "
95 "	3·5 "	11 "	12 "
100 "	2·5 "	9 "	11 "
105 "	2 "	9 "	11 "
110 "	2 "	10 "	11 "
115 "	2 "	10 "	11 "
120 "	2 "	11 "	12 "
125 "	2 "	11 "	15 "
130 "	2 "	12 "	20 "
20 hours	still contracted	normal	
44 "	still slightly smaller than opposite one		

In this case the application of homatropine caused—

(1.) A dilatation of the pupil (4 mm.), which began at the 10th minute, and reached its maximum at the 40th minute. Whilst in this condition, at the 80th minute, eserine was applied, and caused a contraction of the pupil, which began at the 90th minute, and reached its maximum (2 mm.) at the 105th minute.

(2.) A recession of the near point, which began at the

10th minute, and reached its maximum at the 65th, and was then equivalent to 4.83 D. At the 80th minute, while the recession was still great, eserine was applied and caused an approximation, which began at the 85th minute, and reached its maximum at the 100th minute. The maximum approximation was equivalent to 7.78 D. The near point was therefore 4 cm. (3.42 D.) nearer to the eye than at first.

(3.) A recession of the far point, which began at the 15th minute, reached its maximum at the 65th minute, and was then equivalent to 0.6 D. At the 80th minute, when it was much receded, eserine was applied and caused an approximation, which began at the 85th, reached its maximum at the 100th, and was then equivalent to 7.2 D. The far point was therefore 31 cm. (6.71 D.) nearer to the eye than at first.

(4.) A diminution of the range of accommodation, which began at the 5th minute, and reached its maximum at the 65th minute. This decrease at its maximum was equivalent to 4.23 D., that is, 0.79 of the normal range (5.31 D.), so that the total range was then 1.08 D. At the 80th minute, when the range was still greatly decreased (by 3.87 D.), eserine was applied, and caused a temporary disappearance of accommodation at the 90th minute.

CASE II.—A., æt. 23. *Right Eye.* $V. = \frac{6}{6} \bar{d} \frac{+3 \text{ D.}}{+0.75 \text{ D. cyl.}}$

A +5 D. Spherical Lens was worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application</i>	3 mm.	16 cm.	84 cm.
<i>After application—</i>			
5 minutes	3 "	17 "	95 "
10 "	3 "	17 "	72 "
15 "	3 "	18 "	79 "
20 "	3.5 "	19 "	84 "
25 "	3.5 "	24 "	79 "
30 "	3.5 "	24 "	85 "
35 "	4 "	31 "	87 "
40 "	5 "	28 "	92 "
45 "	5 "	32 "	92 "

CASE II—*continued*.

Time.	Pupil.	Near point.	Far point.
<i>After application—</i>			
50 minutes	5 mm.	34 cm.	98 cm.
55 "	5.5 "	32 "	97 "
60 "	5 "	34 "	98 "
65 "	5.5 "	35 "	99 "
70 "	5.5 "	40 "	95 "
75 "	5.5 "	39 "	103 "
80 "	5.5 "	35 "	94 "
85 "	5.5 "	34 "	94 "
90 "	5.5 "	30 "	102 "
95 " (eserine applied)	6 "	29 "	100 "
100 "	5 "	22 "	64 "
105 "	5 "	16 "	28 "
110 "	5 "	16 "	23 "
115 "	5 "	15 "	21 "
120 "	4.5 "	14 "	24 "
125 "	4 "	16 "	22 "
130 "	4 "	16 "	24 " $V. = \frac{6}{5}$
3.5 hours	normal	normal	

In this case the application of homatropine caused—

(1.) A dilatation of the pupil (3 mm.), which began at the 20th minute, and reached its maximum at the 95th minute. Whilst in this condition, at the 95th minute, eserine was applied and caused a contraction of the pupil, which began at the 100th minute, and reached its maximum (4 mm.) at the 125th minute.

(2.) A recession of the near point, which began at the 5th minute, and reached its maximum at the 70th, being then equivalent to 3.75 D. At the 95th minute, when the recession was still great, eserine was applied, and caused an approximation, which began at the 100th minute, and reached its maximum at the 120th minute. The maximum approximation was equivalent to 3.69 D. The near point was therefore 2 cm. (0.89 D.) nearer to the eye than at first.

(3.) A variability in the position of the far point. The maximum recession occurred at the 75th minute, and was equivalent to 0.22 D. The maximum approximation

occurred at the 10th minute, and was equivalent to 0.2 D. At the 95th minute eserine was applied, and caused an approximation, which began at the 100th minute, reached its maximum at the 115th minute, and was then equivalent to 3.78 D. The far point was therefore 63 cm. (3.57 D.) nearer to the eye than at first.

(4.) A diminution in the range of accommodation, which began at the 5th minute, and reached its maximum at the 70th minute. This decrease at its maximum was equivalent to 3.61 D.; that is, 0.71 D. of the normal range (5.06 D.), so that the total range was then 1.45 D. At the 95th minute, when the range was still greatly diminished, (by 2.61 D.), eserine was applied, and caused a temporary diminution of the range, which was at its maximum at the 125th minute.

CASE III.—C. P., æt. 21. *Right Eye.* A +2 D. Spherical Lens worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application</i>	3.5 mm.	11 cm.	114 cm.
<i>After application—</i>			
5 minutes	4 "	11 "	95 "
10 "	4.5 "	12 "	99 "
15 "	6.5 "	13 "	105 "
20 "	8 "	17 "	127 "
25 "	8 "	22 "	112 "
30 "	8.5 "	25 "	120 "
35 "	8.5 "	31 "	127 "
40 "	8.5 "	37 "	132 "
45 "	8.5 "	37 "	133 "
50 "	8.5 "	37 "	133 "
55 "	8.5 "	39 "	133 "
60 " (eserine applied)	8.5 "	34 "	133 "
65 "	8.5 "	23 "	103 "
70 "	8.5 "	14 "	70 "
75 "	7 "	12 "	41 "
80 "	5 "	12 "	18 "
85 "	3 "	11 "	63 "
90 "	3.5 "	10 "	81 "
95 "	3.5 "	11 "	103 "
100 "	3 "	10 "	103 "
105 "	2.5 "	10 "	114 "
110 "	2.75 "	10 "	133 "
120 "	3 "	10 "	133 "
130 "	3 "	10 "	133 "

In this case the application of homatropine caused—

(1.) A dilatation of the pupil (3·5 mm.), which began at the 5th minute, and reached its maximum at the 30th minute. Whilst in this condition, at the 60th minute, eserine was applied, and caused a contraction of the pupil, which began at the 75th minute, and reached its maximum (2·5 mm.) at the 105th minute.

(2.) A recession of the near point, which began at the 10th minute, and reached its maximum at the 55th minute, being then equivalent to 6·53 D. At the 60th minute, when the recession was still great, eserine was applied, and caused an approximation, which began at the 65th minute, and reached its maximum at the 90th minute. The maximum approximation was equivalent to 7·06 D.; the near point was therefore 1 cm. (1·09) nearer to the eye than at first.

(3.) A variability in the position of the far point. The maximum recession occurred at the 45th minute, and was equivalent to 0·12 D. The maximum approximation occurred at the 5th minute, and was equivalent to 0·18 D. At the 60th minute eserine was applied, and caused an approximation, which began at the 65th minute, reached its maximum at the 80th minute, and was then equivalent to 4·75 D. The far point was therefore 96 cm. (4·68 D.) nearer to the eye than at first.

(4.) A diminution of the range of accommodation, which began at the 5th minute, and reached its maximum at the 55th minute. This decrease at its maximum was equivalent to 6·41 D., that is, 0·78 of the normal range (8·22 D.), so that the total range was then 1·81 D. At the 60th minute, when the range was still greatly decreased (by 6·03 D.), eserine was applied, and caused an increase of the range of accommodation, which was at its maximum at the 110th minute, when the total range was 9·25 D.

CASE IV.—D., æt. 23. *Right Eye.* A +1 D. Spherical Lens worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application</i>	3 mm.	13 cm.	50 cm.
<i>After application—</i>			
5 minutes.....	3 "	13 "	50 "
10 ".....	3 "	15 "	50 "
15 ".....	3.5 "	16 "	50 "
20 ".....	3.75 "	14 "	46 "
25 ".....	5 "	17 "	48 "
30 ".....	6.5 "	22 "	47 "
35 ".....	7 "	20 "	48 "
40 ".....	8 "	23 "	46 "
45 ".....	9 "	23 "	48 "
50 ".....	9 "	25 "	47 "
55 ".....	9 "	28 "	48 "
60 ".....	9 "	26 "	43 "
65 ".....	9 "	29 "	43 "
70 ".....	9 "	29 "	43 "
75 ".....	9 "	29 "	50 "
80 " (eserine applied)	9 "	28 "	43 "
85 ".....	9 "	19 "	35 "
90 ".....	9 "	17 "	27 "
95 ".....	8 "	14 "	18 "
100 ".....	3.5 "	13 "	18 "
105 ".....	2.5 "	13 "	22 "
110 ".....	2.5 "	12 "	31 "
115 ".....	2 "	14 "	29 "
120 ".....	2 "	11 "	30 "
125 ".....	2 "	12 "	28 "
130 ".....	2 "	12 "	41 "
135 ".....	2 "	13 "	40 "
140 ".....	2 "	14 "	

In this case the application of homatropine caused—

(1.) A dilatation of the pupil (3 mm.), which began at the 15th minute, and reached its maximum at the 45th minute. Whilst in this condition, at the 80th minute, eserine was applied, and caused a contraction of the pupil, which began at the 95th minute, and reached its maximum (2 mm.) at the 15th minute.

(2.) A recession of the near point, which began at the 10th minute, reached its maximum at the 65th minute, and was then equivalent to 4.24 D. At the 80th minute, when the recession was still great, eserine was applied,

and caused an approximation, which began at the 85th minute, and reached its maximum at the 120th minute. The maximum approximation was equivalent to 5.52 D.; the near point was therefore 2 cm. (1.4 D.) nearer to the eye than at first.

(3.) An approximation of the far point, which began at the 20th minute, reached its maximum at the 60th minute, and was then equivalent to 0.32 D. At the 80th minute, when it was much receded, eserine was applied, and caused an approximation, which began at the 85th minute, and reached its maximum at the 95th minute; it was then equivalent to 3.23 D. The far point was therefore 32 cm. (3.55 D.) nearer to the eye than at first.

(4.) A diminution in the range of accommodation, which began at the 10th minute, and reached its maximum at the 65th minute. This decrease at its maximum was equivalent to 4.65 D., that is, 0.8 of the normal range (5.69 D.), so that the total range was then 1.13 D. At the 80th minute, when the range was still greatly diminished (by 4.44 D.), eserine was applied, and caused an increase of the range of accommodation, which reached its maximum at the 130th minute, when the range was 5.89 D.

Summary.—It seems that the application of homatropine caused—

(1.) A dilatation of the pupil, which began between the 5th and 20th minutes, and reached its maximum between the 30th and 95th minutes. Eserine was applied between the 60th and 95th minutes, and caused a contraction of the pupil, which began between the 5th and 15th minutes and reached its maximum between the 25th and 45th minutes.

(2.) A recession of the near point, which began between the 5th and 10th minutes, reached its maximum between the 55th and 70th minutes, and was then equivalent to from 3.75 D. to 6.53 D. Eserine was applied between the 60th and 95th minutes, and caused an approximation, which began at the 5th minute, reached its maximum from the 20th to the 40th, and was equivalent to from 3.69 D.

to 7.78 D., so that the near point was from 1-4 cm. (0.89 to 3.42 D) nearer to the eye than at first.

(3.) A variability in the position of the far point. The maximum approximation occurred between the 5th and 45th minutes, and was equivalent to from 0.18 D. to 0.32 D. The maximum recession occurred between the 45th and 75th minutes, and was equivalent to from 0.12 D. to 0.6 D. Eserine was applied between the 60th and 95th minute, and caused an approximation, which began at the 5th minute, reached its maximum between the 15th and 20th minutes, and was then equivalent to from 3.23 D. to 7.2 D., so that the far point was from 31 cm. to 96 cm. (3.55 D. to 6.71 D.) nearer to the eye than in the normal state.

(4.) A diminution of the range of accommodation, which began between the 5th and the 10th minute, reached its maximum between the 55th and 70th minutes, and was then equivalent to from 3.61 D. to 6.14 D., that is, 0.71 to 0.8 of the normal range (5.06 D. to 8.22 D.), so that the total range was then from 1.08 D. to 1.81 D. Eserine was applied between the 60th and 95th minutes, and caused sometimes a temporary increase, and sometimes a temporary decrease of the range of accommodation.

Taking the average, it seems that the application caused—

(1.) A dilatation of the pupil (3.37 mm.), which began at the 12.5 minute, and reached its maximum at the 52.5 minute. Eserine was applied at the 78.75 minute, and caused a contraction, which began at the 11.25 minute (2.62 mm.), and reached its maximum at the 33.75 minute.

(2.) A recession of the near point, which began at the 8.75 minute, reached its maximum at the 63.75 minute, and was then equivalent to 4.84 D. Eserine was applied at the 78.75 minute, and caused an approximation, which began at the 5th minute, reached its maximum at the 28.75 minute, and was then equivalent to 6.01 D., so that the near point was 2.25 cm. (1.7 D.) nearer to the eye than it was in the normal condition.

(3.) A variability in the position of the far point. The maximum approximation occurred at the 25th minute, and was equivalent to 0.23 D. The maximum recession occurred at the 61.67 minute, and was equivalent to 0.31 D. Eserine was applied at the 78.75 minute, and caused an approximation, which began at the 5th minute, reached its maximum at the 18.75 minute, and was then equivalent to 4.74 D., so that the far point was 55.5 cm. (4.63 D.) nearer to the eye than it was in the normal state.

(4.) A diminution of the range of accommodation, which began at the 6.25 minute, reached its maximum at the 63.75 minute, and was then equivalent to 4.63 D., that is, 0.76 of the normal range (6.07 D.), so that the total range was then 1.37 D. Eserine was applied at the 78.75 minute, and caused sometimes a temporary increase, and sometimes a temporary decrease of the range. (See Chart III.)

IV. *The Action of Homatropine + Cocaine and Eserine.*

CASE I.—A., æt. 23. *Left Eye.* $V. = \frac{6}{6}$ Hm. 0.5 D. A +2 D.

Spherical Lens was worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application</i>	3 mm.	13 cm.	105 cm.
<i>After application—</i>			
5 minutes	3 "	14 "	101 "
10 "	3.5 "	16 "	78 "
15 "	4.5 "	18 "	81 "
20 "	5 "	20 "	84 "
25 "	5.5 "	26 "	81 "
30 "	6 "	31 "	87 "
35 "	6.5 "	35 "	91 "
40 "	7 "	38 "	87 "
45 "	7.5 "	38 "	84 "
50 "	7.5 "	38 "	98 "
55 "	7.5 "	43 "	93 "
60 "	7.5 "	39 "	95 "
65 "	7.5 "	37 "	92 "
70 "	7.5 "	36 "	94 "
75 "	8 "	39 "	97 "
80 "	7.5 "	36 "	97 "

CASE I—*continued.*

Time.	Pupil.	Near point.	Far point.
85 minutes	..	37 cm.	96 cm.
90 "	9 mm.	34 "	97 "
95 " (eserine applied)			
100 "	7·5 "	22 "	47 "
105 "	7·5 "	22 "	23 "
110 "	7·5 "	15 "	16 "
115 "	7·5 "	15 "	16 "
120 "	6 "	15 "	19 "
125 "	5 "	14 "	17 "
130 "	4·5 "	14 "	22 "
135 "	3·5 "	13 "	40 "
3·5 hours	normal	normal	

In this case the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil (3 mm.), which began at the 10th minute, and reached its maximum at the 90th minute. Whilst in this condition, at the 95th minute, eserine was applied and caused a contraction of the pupil, which began at the 100th minute, and reached its maximum (3·5 mm.) at the 135th minute.

(2.) A recession of the near point, which began at the 5th minute, reached its maximum at the 55th minute, and was then equivalent to 5·37 D. At the 95th minute, when the recession was still great, eserine was applied and caused an approximation, which began at the 100th minute, and reached its maximum at the 135th minute. The maximum approximation was equivalent to 4·75 D. The near point was therefore not nearer to the eye than at first.

(3.) An approximation of the far point, which began at the 5th minute, reached its maximum at the 100th minute, and was then equivalent to 0·33 D. At the 95th minute, when it was somewhat approximated, eserine was applied and caused an approximation, which began at the 100th minute, and reached its maximum at the 110th,

being then equivalent to 5.22 D. The far point was therefore 89 cm. (5.3 D.) nearer to the eye than at first.

(4.) A diminution in the range of accommodation, which began at the 5th minute, and reached its maximum at the 55th minute. This decrease at its maximum was equivalent to 5.49 D., that is 0.81 D. of the normal range (6.74 D.), so that the total range was then 1.25 D. At the 95th minute, when the range was still greatly decreased (by 4.83 D.), eserine was applied and caused a still further temporary diminution. The maximum diminution occurred at the 105th minute, when the total range was 0.19 D.

CASE II.—P., æt. 21. *Left Eye.* $V. = \frac{6}{6}$. Emmetropic. A

+2 D. Spherical Lens was worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application</i>	4 mm.	13 cm.	42 cm.
<i>After application—</i>			
5 minutes	4.5 "	13 "	44 "
10 "	8 "	15 "	48 "
15 "	10 "	18 "	47 "
20 "	10 "	22 "	45 "
25 "	10 "	29 "	50 "
30 "	10 "	34 "	49 "
35 "	10 "	35 "	52 "
40 "	10 "	42 "	51 "
45 "	10 "	47 "	64 "
50 "	10 "	46 "	61 "
55 "	10 "	47 "	67 "
60 "	10 "	50 "	63 "
65 "	10 "	51 "	68 "
70 "	10 "	48 "	65 "
75 "	10 "	46 "	68 "
80 " (eserine applied) ..	10 "	43 "	67 "
85 "	9.5 "	13 "	14 "
90 "	9 "	12 "	12 "
95 "	7 "	11 "	
100 "	5.5 "	11 "	
105 "	4.5 "	10 "	
110 "	3.5 "	10 "	
115 "	3 "	11 "	
120 "	3 "	11 "	
125 "	2.5 "	11 "	
130 "	2.5 "	11 "	
20 hours	normal		

In this case the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil (4 mm.), which began at the 5th minute, and reached its maximum at the 15th minute. Whilst in this condition, at the 80th minute, eserine was applied and caused a contraction of the pupil, which began at the 85th minute, and reached its maximum (2.5 mm.) at the 125th minute.

(2.) A recession of the near point, which began at the 10th minute, and reached its maximum at the 65th minute, and was then equivalent to 5.73 D. At the 80th minute, when the recession was still great, eserine was applied and caused an approximation, which began at the 85th minute, and reached its maximum at the 105th minute. The maximum approximation was equivalent to 7.68 D. The near point was therefore 3 cm. (2.31 D.) nearer to the eye than at first.

(3.) A recession of the far point, which began at the 5th minute, reached its maximum at the 65th minute, and was then equivalent to 0.91 D. At the 80th minute, when it was much receded, eserine was applied and caused an approximation, which began at the 85th minute, reached its maximum at the 90th minute, and was then equivalent to 6.84 D. The far point was therefore 30 cm. (5.95 D.) nearer to the eye than at first.

(4.) A diminution of the range of accommodation, which began at the 10th minute, and reached its maximum at the 60th minute. This decrease at its maximum was equivalent to 4.9 D., that is, 0.92 of the normal range (5.31 D), so that the total range was then 0.41 D. At the 80th minute, when the range was still greatly decreased (by 4.48 D.), eserine was applied and caused a still further temporary diminution. At the 90th minute the range was *nil*.

CASE III.—C. P., æt. 19. *Left Eye.* $V. = \frac{6}{6}$. Hm. 1 D. A
+1.75 D. Spherical Lens was worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application</i>	3.5 mm.	11 cm.	125 cm.
<i>After application—</i>			
5 minutes	4 "	12 "	97 "
10 "	6 "	13 "	93 "
15 "	8 "	21 "	98 "
20 "	9.5 "	39 "	
25 "	10 "	42 "	
30 "	10 "	56 "	
35 "	10 "	68 "	
40 "	10 "	60 "	105 "
45 "	10 "	65 "	101 "
50 " (eserine applied) ..	10 "	65 "	92 "
55 "	9.5 "	35 "	110 "
60 "	9.5 "	19 "	62 "
65 "	9.5 "	12 "	21 "
70 "	8 "	12 "	67 "
75 "	5.5 "	12 "	90 "
80 "	6.5 "	12 "	90 "
85 "	5 "	11 "	90 "
90 "	6.5 "	12 "	133 "
95 "	6.5 "	11 "	133 "
100 "	5.5 "	12 "	133 "
105 "	4.5 "	12 "	133 "
110 "	5 "	11 "	133 "
120 "	5.5 "	13 "	133 "
130 "	5.5 "	13 "	133 "

In this case the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil (3.5 mm.), which began at the 5th minute, and reached its maximum at the 25th minute. Whilst in this condition, at the 50th minute, eserine was applied and caused a contraction of the pupil, which began at the 55th minute, and reached its maximum (4.5 mm.) at the 105th minute.

(2.) A recession of the near point, which began at the 5th minute, reached its maximum at the 35th minute, and was then equivalent to 7.62 D. At the 50th minute, when the recession was still great, eserine was applied and caused an approximation, which began at the 55th

minute, and reached its maximum at the 85th minute. The maximum approximation was equivalent to 7.55 D. The near point was therefore not nearer to the eye than at first.

(3.) An approximation of the far point, which began at the 5th minute, reached its maximum at the 50th minute, and was then equivalent to 0.29 D. At the 50th minute eserine was applied and caused an approximation, which began at the 60th minute, and reached its maximum at the 65th, being then equivalent to 3.67 D. The far point was therefore 104 cm. (3.96 D.) nearer to the eye than at first.

(4.) A diminution of the range of accommodation, which began at the 5th minute, and reached its maximum at the 50th minute. This decrease at its maximum was equivalent to 7.84 D., that is, 0.94 of the normal range (8.29 D.), so that the total range was then 0.45 D. At the 50th minute, when the range was greatly decreased (by 7.84 D.), eserine was applied and caused an increase of the range of accommodation. The maximum increase occurred at the 95th minute, when the total range was 8.34 D.

CASE IV.—D., æt. 23. *Left Eye.* A +1 D. Spherical Lens worn during the Observation.

Time.	Pupil.	Near point.	Far point.
<i>Before application</i>	3 mm.	12 cm.	56 cm.
<i>After application—</i>			
5 minutes	3 "	12 "	67 "
10 "	3 "	14 "	58 "
15 "	3.5 "	17 "	54 "
20 "	3.75 "	20 "	56 "
25 "	5.5 "	20 "	51 "
30 "	Oval 8 " 6.5 mm.	20 "	49 "
35 "	9 " 8 "	25 "	53 "
40 "	9 "	29 "	53 "
45 "	10 "	30 "	52 "
50 "	10 "	34 "	52 "
55 "	10 "	34 "	50 "
60 "	10 "	35 "	50 "

CASE IV—*continued.*

Time.	Pupil.	Near point.	Far point.
<i>After application--</i>			
65 minutes	10 mm.	36 cm.	46 cm.
70 "	10 "	34 "	52 "
75 "	10 "	38 "	55 "
80 " (eserine applied)	10 "	32 "	51 "
85 "	10 "	22 "	38 "
90 "	10 "	18 "	25 "
95 "	9 "	14 "	16 "
100 "	5 "	14 "	19 "
105 "	3 "	13 "	19 "
110 "	2.75 "	13 "	32 "
115 "	2 "	15 "	31 "
120 "	2 "	13 "	43 "
125 "	2 "	12 "	41 "
130 "	2 "	14 "	45 "
135 "	2 "	13 "	46 "
140 "	2 "	13 "	43 "

In this case the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil (3 mm.), which began at the 15th minute, and reached its maximum at the 45th minute. Whilst in this condition, at the 80th minute, eserine was applied and caused a contraction of the pupil, which began at the 95th minute, and reached its maximum (2 mm.) at the 115th minute.

(2.) A recession of the near point, which began at the 10th minute, reached its maximum at the 75th minute, and was then equivalent to 5.76 D. At the 80th minute, when the recession was still great, eserine was applied and caused an approximation, which began at the 85th minute, and reached its maximum at the 125th minute. The maximum approximation was equivalent to 5.21 D. The near point was therefore nearer to the eye than at first.

(3.) A variability in the position of the far point. The maximum approximation occurred at the 65th minute, and was equivalent to 0.39 D. The maximum recession occurred at the 5th minute, and was then equivalent to 0.29 D. At the 80th minute eserine was applied and

caused an approximation, which began at the 85th minute, reached its maximum at the 95th, and was then equivalent to 4.29 D. The far point was therefore 40 cm. (4.47 D.) nearer to the eye than at first.

(4.) A diminution in the range of accommodation, which began at the 10th minute, and reached its maximum at the 65th minute. This decrease at its maximum was equivalent to 5.94 D., that is, 0.91 of the normal range (6.55 D.), so that the total range was then 0.61 D. At the 80th minute, when the range was still greatly decreased (by 5.39 D.), eserine was applied and caused some increase of the range.

Summary.—It seems that the application of homatropine + cocaine caused—

(1.) A dilatation of the pupil (3 to 4 mm.), which began between the 5th and 15th minutes, and reached its maximum between the 15th and 90th minutes. The application of eserine between the 50th and 95th minutes caused a contraction of the pupil, which began in 5 to 15 minutes, and reached its maximum (2 to 4.5 mm.) in from 35 to 55 minutes.

(2.) A recession of the near point, which began between the 5th and 10th minutes, reached its maximum between the 35th and 75th minutes, and was then equivalent to from 5.37 D. to 7.62 D. The application of eserine between the 50th and 95th minutes caused an approximation, which began in 5 minutes, reached its maximum in 25 to 40 minutes, and was then equivalent to from 4.57 D. to 7.68 D., so that the near point was in the same situation or nearer than before the application of cocaine and homatropine.

(3.) A variability in the position of the far point. The maximum approximation occurred between the 10th and 65th minutes, and was equivalent to from 0.29 D. to 0.39 D. The maximum recession occurred between the 5th and 65th minutes, and was equivalent to from 0.29 D. to 0.91 D. The application of eserine between the 50th

and 95th minutes caused an approximation, which began between the 5th and 10th minutes, reached its maximum between the 10th and 15th minutes, and was then equivalent to from 3.67 D. to 6.84 D., so that the far point was from 30 cm. (5.95 D.) to 104 cm. (3.96 D.) nearer to the eye than before the application of homatropine and cocaine.

(4.) A diminution of the range of accommodation, which began between the 5th and 10th minutes, reached its maximum between the 50th and 60th minutes, and was then equivalent to from 4.9 D. to 7.84 D., that is, 0.81 to 0.94 of the normal range (5.31 D. to 8.29 D.), so that the total range was then 0.41 D. to 1.25 D. The application of eserine between the 50th and 95th minutes sometimes caused a further temporary diminution, and sometimes a temporary increase of the range.

Taking averages, it seems that this application caused—

(1.) A contraction of the pupil (3.37 mm.), which began at the 8.75 minute, and reached its maximum at the 43.75 minute. Eserine was applied at the 76.25 minute, and caused a contraction of the pupil, which began at the 7.5 minute, and reached its maximum (3.12 mm.) at the 43.75 minute.

(2.) A recession of the near point, which began at the 7.5 minute, reached its maximum at the 57.5 minute, and was then equivalent to 6.12 D. Eserine was applied at the 76.25 minute and caused an approximation, which began at the 5th minute, reached its maximum at the 32.5 minute, and was then equivalent to 6.14 D., so that the near point was 0.75 cm. (0.58 D.) nearer to the eye than at first.

(3.) A variability in the position of the far point. The maximum approximation occurred at the 41.67 minute, and was equivalent to 0.34 D. The maximum recession occurred at the 65th minute, and was equivalent to 0.6 D. Eserine was applied at the 76.25 minute and caused an

approximation, which began at the 6.25 minute, reached its maximum at the 13.75 minute, and was equivalent to 5 D., so that the far point was 65.75 cm. (4.92 D.) nearer to the eye than at first.

(4.) A diminution of the range of accommodation, which began at the 7.5 minute, and reached its maximum at the 57.5 minute. The maximum diminution was equivalent to 6.04 D., that is, 0.89 of the normal range (6.72 D.), so that the total range was then 0.68 D. Eserine was applied at the 76.25 minute, and sometimes caused a temporary increase, and sometimes a temporary decrease of the range. (*See Chart 4.*)

Practical Deduction.—After paralysis of the sphincter pupillæ and ciliary muscle has been effected by the application of homatropine, or of homatropine + cocaine, the application of eserine causes a contraction of the pupil, and an approximation of the near point to such an extent that in the great majority of cases the individual can in a few minutes resume work of all kinds without inconvenience.

Table showing the Action (average) of Eserine, Pilocarpine, Homatropine, and Homatropine + Cocaine.

	Pupil.	Movement of near point.		Movement of far point.		Alteration of range of accommodation.	
		Approximation.	Recession.	Approximation.	Recession.	Increase.	Diminution.
Time of commencement of action.	Eserine.....	7·27 min.	..	6·58 min.	..	11·25 min.	5 min.
	Pilocarpine ..	13·75 "	..	15 "	..	..	5·83 min.
	Homatropine.	..	6·67 min.	..	..	..	..
	Homatropine + cocaine	..	6·67 "	..	..	..	..
Time of maximum action.	Eserine	17·33 min.	..	18·14 min.	..	52·22 min.	22·5 min.
	Pilocarpine ..	22·5 "	..	26·67 "	..	60·9 "	65 "
	Homatropine.	..	61·67 min.	53·33 "	63·33 min.	..	59·17 "
	Homatropine + cocaine	..	61·67 "	50 "	77 "	..	..
Time of cessation of action.	Eserine	24-48 hrs.	..	55·22 min.	..	8 hours	8·75 hours.
	Pilocarpine ..	48 hrs.	..	60·83 "	..	70 min.	25·67 "
	Homatropine.	..	8·75 hrs.	..	..	..	..
	Homatropine + cocaine	..	25·67 "	..	..	..	..

		Pupil.		Movement of near point.		Movement of far point.		Alteration of range of accommodation.	
		Contraction.	Dilatation.	Approximation.	Recession.	Approximation.	Recession.	Increase.	Diminution.
Amount of maximum action.	Eserine	..	..	9.89 D.	..	4.54 D.	..	8.24 D, <i>i.e.</i> , 1.319 of normal range 6.20 D. 2.72 D, <i>i.e.</i> , 0.36 of normal range 7.84 D. ..	1.68 D, <i>i.e.</i> , 0.26 of normal range.
	Pilocarpine ..	..	..	3.51 D.	..	2.7 D.	..	..	2.96 D.
	Homatropine.	..	..	..	6.33 D.	0.42 D.	0.78 D.	..	6.12 D, <i>i.e.</i> , 0.86 of normal range 7.14 D.
	Homatropine + cocaine	..	..	..	6.97 D.	0.43 D.	0.75 D.	..	6.58 D, <i>i.e.</i> , 0.91 of normal range 7.23 D.

LITERATURE.

We append a list of the essays which have appeared on this subject of the action of homatropine, and to which we have been able to obtain access. No previous observer appears to have worked in the same manner, so that any quotations for purposes of comparison would be useless. On the subject of the action of homatropine and cocaine so far as we are aware there has been no publication.

- (1.) Tweedy, J. On the Mydriatic Properties of Homatropine or Oxytolulatropine, with an Account of its General Physiological Action. By Sydney Ringer. *Lancet*, I, p. 795. 1880.
- (2.) Pautynski. Pilocarpin und Homatropin. *Klin. Monatsblätt. für Augenh.* 1880. S. 343.
- (3.) Fronmüller. Das Bromwasserstoffsäure Homatropin. *Memorab.* 7. S. 298. 1880.
- (4.) Bertheau. Das Homatropin. *Berlin Klin. Wochens.* Nr. 41. 1880.
- (5.) Schell, H. S. A New Mydriatic. Additional Note. *Philadelphia Med. Times*, XI, pp. 7 and 47. 1880.
- (6.) Risley, S. D. Comparative Value of the Mydriatics. *Transactions American Ophthalm. Soc.* 1881. P. 228.
- (7.) Risley, S. D. The Value of Homatropine Hydrobromate in Ophthalmic Practice. *American Jour. Med. Science.* 11, 161. 1881.
- (8.) Schäfer, H. Comparative Investigations into the Effects upon the Eye of Atropine, Duboisine, and Homatropine. *Knapp's Archives of Ophthalmology.* Vol. X, p. 196. 1881.
- (9.) Little. Homatropine Hydrobromate. Is it a Powerful Mydriatic? *Philadelphia Med. Times*, Feb. 26th, 1881.
- (10.) Oliver. Comparative Action of Homatropine and of Sulphate of Atropia upon the Iris and Ciliary Muscle. *American Jour. Med. Science*, July, p. 150. 1881.
- (11.) Schirmer. Homatropin. *Lex. Art. Real-Encyclop.* Bd. VI. 1881.
- (12.) Sedan. Emploi de l'Homatropine en Oculistique. *Gaz. Hébdom.*, 18, S. 494. 1881.
- (13.) Krosta. Ueber Homatropinum Hydrobromatum *Sitzungsberichte der Gesell. der Charité Aertze*, von 23 Dezemb. 1880. *Berlin Klin. Wochensch.* 1881. N. 6.

MISCELLANEOUS CASES.

By E. NETTLESHIP.

(Continued from page 77.)

Mydriasis without Cycloplegia, affecting one Eye of a Man in an early stage of Locomotor Ataxy.

William W., labourer, æt. 35 (T. 5, p. 60), was brought by Mr. Clutton from his out-patient room, on December 31st, 1886. He was under Mr. Clutton's care for painless effusion into the right knee, of a year's duration, with considerable relaxation of ligaments and free lateral movement with some grating. Knee-reflexes absent, liable to sharp sudden "shocking" pains in the thighs and legs, especially at change of weather; they last a few hours, and then pass off, perhaps for weeks. Some incontinence of urine at night. Gait and sexual functions not altered. Vision and accommodation equal and perfect in each eye (p. p. being at 22 to 25 cm. in each eye with Hm. 0.5 D.) but the pupils were not alike. The right pupil acted well to light and accommodation, and measured from 3 to 4 mm., dilating to about 5 under 2 per cent. cocaine, and contracting to rather less than 2 under eserine; the left measured 5.5 mm., and was quite motionless both to light and to accommodation, it dilated to 8.5, three-quarters of an hour after cocaine 2 per cent. had been used, and in this state contracted very slowly to 5 or 6 mm. when strongly lighted, eserine 1 per cent. contracted it to rather less than 2 mm. in half an hour.

There is no history of injury to either eye; the patient probably had syphilis 12 years ago. His son, aged 12, is now under Dr. Brailey's care in Guy's Hospital, with severe interstitial keratitis.

Wide Mydriasis of both Eyes, for 15 years, with only slight Cycloplegia. Locomotor Ataxy.

Mr. K., æt. 47, was sent by Dr. Hughlings Jackson, in 1881 (P. 5, 18). The refraction was natural and acuteness of vision

nearly normal in each eye. With each he could read 4 J. or 6 J. up to 33 cm., but preferred a distance of 40 cm., and required +3 D. for reading 1 J. at 22 cm. At his age, with emmetropic refraction, he should according to rule have required only +1.5 D. for reading at 22 cm. We may conclude, therefore, that his Acc. was relatively defective to the extent of 1.5 D. but not more. The pupils were very large and quite motionless both to light and accommodation: on February 9th, the R. is noted as 7.5 mm., the L. 8 mm.; on March 16th the R. 8 mm., the L. 9 mm. Both pupils contracted well to eserine. In the L. there was old choroidal disturbance about the y.s., and in both the o. d. was rather pale and hazy; there had probably been some choroido-retinitis when he had syphilis 22 years before.

Mr. K. was under Dr. Jackson's care for well-marked locomotor ataxy with severe gastric attacks. It seemed likely that dilatation of the pupils had been one of the earliest symptoms of the disease, for he said that 15 years before I saw him a doctor had told him that the pupils were too large, and 7 years later Mr. Critchett said they were extremely large. He believed that they had previously been of ordinary size, not particularly small. That the ciliary muscle never suffered in proportion was proved by the power of the glasses he was wearing; but that it had suffered in some degree was shown by his having taken to weak spectacles at the age of 35, about 3 years after the mydriasis was first noticed, and 12 years before I saw him.

For the last 2 or 3 years there had been diplopia, due, as examination showed, to paresis (varying in degree) of the L. inferior oblique.

Mydriasis without Cycloplegia affecting one Eye and coming on several years after a severe Abdominal Illness following Injury. Knee-reflexes absent.

Miss Florence P. (P. 9, p. 44), a quick, bright child, æt. 11, florid and well grown, was seen in consultation with Dr. Clapton, on January 2nd, 1884, on account of the peculiarity of her left pupil. The left pupil was more than twice as wide as the right, measuring 6.5 mm., and almost motionless;

when very brightly lighted it slowly contracted a little, but was never less than 5.5. She saw $\frac{6}{6}$ with this eye and read 1 J. easily up to about 8 cm.; Hm. 0.75. The other (right) eye was natural in all respects, the pupil, about 3 mm., acting perfectly; no Hm.; fundus normal in each. The palpebral fissure was of equal width on the two sides. The inequality of the pupils had been noticed for some months, but not so much as 12 months, and no cause had been assigned, but it seemed possible that the condition was connected with the illness about to be mentioned. She had never had fits. The family history was good except that the eldest child (a girl) died of phthisis.

When the patient was 5 she was run over by a four-wheeled fly; she was rolled over and over and the wheel passed over her twice, going over the upper part of the abdomen; there was no injury to the head. She was seen by Dr. Clapton, Dr. Acland, and others, and rupture of liver was at first suspected. For the first three weeks she was weak, but no severe symptoms seem to have occurred. Then her belly swelled very much, she was in great pain and became extremely ill; she was ill from May until October, and became extremely thin, like skin and bone. The belly remained too big for 18 months, but eventually she got perfectly well; no blood or pus was ever passed. Though no precise diagnosis was arrived at and different views were taken of the connection between this illness and the accident, there is no doubt that she was for some time in great danger. Tubercular disease of mesenteric glands was suspected for a time.

I saw her again a year later, January, 1885, the left pupil was in exactly the same state, if anything a little larger, accommodation was still perfect, there being no decided difference in the distance of the near point in the two eyes; the other pupil was, as before, natural. The left (dilated) pupil contracted to pin's-head size after a drop of eserine ($\frac{1}{8}$ per cent.) had been applied, and next morning measured 5 mm. On testing the knee-reflexes no jerk could be obtained on either side after repeated trials. There were no symptoms of abdominal tumour of any kind, and no signs of inherited syphilis.

She was a neurotic child, sleeping badly if at all out of health, and having a peculiar habit of shaking her head quickly when out of doors. She had lately had some "growing pains"

in left leg. She had been complaining lately of seeing patterns and violet and yellow spots before her eyes, especially in the morning.

She came again the following November (1885). She was growing well, had gained flesh, was doing well at school, and had partly got over the shaking of her head. Knee-reflexes were still absent. The left pupil still much larger than the right, but contracting somewhat (from 7 to 5.5 mm.) during strong accommodation; the right pupil however contracting much more (from 6 to 3) under the same test. The left pupil dilated to 9 mm. under cocaine.

Mydriasis without Cycloplegia in one Eye only, of unknown duration. Suspicion of Old Vasomotor Paralysis on same side of Face.

Mr. R., æt. 56, was sent to me by Dr. Gowers in 1879 (P. 3, 66) for examination. He was intemperate, had had two attacks of paraplegia, and was subject to neuralgic pains and "pins and needles." Dr. Gowers considered his paralytic symptoms to be alcoholic. He had probably had syphilis (at least 20 years previously).

For years he had had acne rosacea of the left side of the face, but hardly any spots came on the right side; his right nostril had for a long time been drier than the left; he wore his hat down on the right side, "because the right side of my head is too small," and the right side of the face was rather less mobile than the left during ordinary efforts, though in strong efforts both sides acted equally; he said that he sweated equally on the two sides. He was very deaf of both ears. Smell good.

The pupils were very unequal, the R. the larger; he could not say how long this had been the case, but professed to remember that in childhood he used to like to shut the R. eye, because it felt glaring light more than the L.

Condition of the Eyes.—R. V. $\frac{10}{30}$ badly, with -0.75 D.

$\frac{10}{20}$ partly; reads 4 J. well up to 22 or 24 cm. without a glass. P. measures 7 mm. when looking at distant objects, and con-

tracts a little during Acc., but dilates again; slight opacity at posterior pole of lens, and a few patches of old choroiditis at extreme periphery of fundus. (Action of p. to atropine and eserine not tried.)

L. V. $\frac{10}{20}$ badly, rather improved by -0.75 D.; reads 4 J. up to 22 or 24 cm. without a glass. P. 2.5 to 3 mm., when looking at distant object, contracting moderately during Acc.; interior of eye n., except a path of epithelial distance at y. s. After a drop of duboisine was put in, the p. became larger than the R. p. in its ordinary state.

The condition of the R. p. was the same a fortnight later, and was no doubt permanent.

My notes do not actually state that the reflex action of the pupils to light was tried; but the heading of the case, written at the time, implies that the R. one, at any rate, was inactive to this test.

Wide Mydriasis without Cycloplegia following a severe Blow on Eye.

John L., æt. 27 (Moorfields, 2, p. 1), came to Moorfields on November 11th, 1885, with the left pupil widely dilated (9 mm.), motionless to light and accommodation; V. = $\frac{6}{12}$,

Hm. 1 D. = $\frac{6}{9}$, reads 1 J. p. p., 17 cm.; thus accommodation was perfect or all but so. After three applications of eserine (1 per cent.), the pupil contracted to 1.75 mm., and p. p. came to 7 cm. The other (right) saw $\frac{6}{6}$, had Hm. 0.5D.

and 1 J. p. p. 17 cm.; pupil larger than usual, but active both to light and to accommodation. The fundus in each eye was healthy; there were some nebulae on the left cornea apparently old. Two months before he had a severe blow on the left eye from a stone thrown to meet him as he was driving in a cart; he felt faint, but was able to drive home a mile further on; the upper lid was cut. He was able to open the eye the same day, and found that he could see "nothing at all" with it. The next day he could just see the doctor standing by him; after this the

sight quickly improved, and for the past three weeks had been as good as on admission. Drops were used three or four times at first, but none for several weeks past; some lotion was also used, but was left off two weeks before he came to me. Except the history pointing to corneal ulcers many years before, there seems to have been nothing amiss with his eye until the accident.

Embolism or Thrombosis of Arteria Centralis Retinæ in R., followed by same in L. about 12 days later. Sight retained in exactly symmetrical Sector of each Field; Chronic Renal Disease; Death 2 months after the Retinal Embolism.

Mrs. B., æt. 36 (P. 8, 250), married several years; has had five children; the youngest living is 2 years old; the last pregnancy ended in a bad miscarriage at sixth month, in August, 1882, the child being decomposed. Some years ago, when living in Kent, had ague. No rheumatism or gout. No special reason to suspect syphilis. Was always "nervous," and liable to headaches. Owing to peculiarities of manner, to the history of melancholia in a sister, and to the fact that her husband is a publican, her medical attendant has at various times suspected intemperance, hysteria, and threatened mental disease. She had not been supposed to have either renal or cardiac disease, but she was dyspeptic, rather puffy, and often in the doctor's hands.

One day, on July 18th or 19th, 1883, she found all at once that she could not see properly with her R. eye; she could not see the lower parts of things. She believes it came on quite suddenly. I saw her, in consultation with Dr. Aveling, of Clapton, just a week later, on July 26th, and found the field of vision of the affected eye entirely absent, except on about one-fifth of its area at the upper and outer part, where a sector of sight remained; the lower boundary between blind and seeing part was sharply defined (as tested by the fingers), but the upper boundary seemed to be less defined (Fig. 1). Several of the retinal arteries were evidently obliterated, and represented by mere white lines, the veins rather tortuous, the disc hazy, and some hæmorrhages were present. No white patches seen. The other eye was perfect in every way. Though

the examination was made under difficulties at her home, the history, present symptoms, and appearances justified the diagnosis of either embolism or thrombosis of the arteria centralis

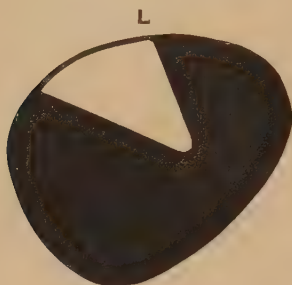


FIG. 2.

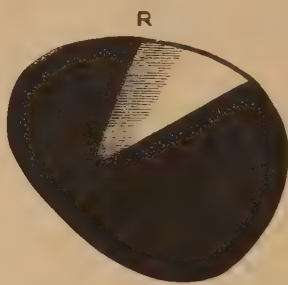


FIG. 1.

retinæ. She was a good deal frightened, and in a state of suppressed excitement, and as I could not say much about the hope of recovery of the affected eye, I said a good deal to her and her husband about the extreme improbability of the same thing happening to the other eye. After my visit the heart was again examined, and found to be hypertrophied, but without signs of valvular disease, and the urine found to be albuminous. During the night of August 1st, having occasion to get up and light the gas, she found that the sight of the other (L.) eye had gone in exactly the same way; between this date and the 9th, when I saw her again (at my house), the sight remained the same. At that date (August 9th) the field of the L. was in just the same state as that of the R. had been, the upper-out one-fourth or one-fifth alone remaining intact (Fig. 2). With each eye she could see 50 Sn. at 20' by moving her eye about so as to catch the letters; T. n. in each. In the L. (second) eye I saw no obliterated arteries, but none of them pulsated upon pressure, and the trunk was therefore probably blocked; a few small vessels over inner edge of disc were enlarged and very tortuous, showing collateral circulation; one or two small hæmorrhages; numerous small spots of pigment surrounded by pale areas, on the choroid, chiefly at the periphery, such as might have been left by syphilitic choroiditis, or by a previous crop of scattered retinal hæmorrhages.

In the R. at this date the artery going down-in was con-

verted into a white line for a long distance, but I thought it showed a very narrow blood column; an extremely tortuous large vessel seen near to this obliterated artery was taken for its companion vein. A few spots of pigment disturbance at the periphery, but not nearly so many as in the L.; a few scattered recent round hæmorrhages. She looked very unwell, was soon tired, and complained of alternate chills and sweats, and of pains in head. The urine showed a considerable cloud of albumen; no sugar. No anasarca, no sickness.

On 20th the R. (first) eye seemed worse, seeing only 200 Sn. at 20'; the L., however, had much improved, seeing 30 Sn., and almost 20 Sn. at 20', and reading words of 8 or 10 J.; sector of unimpaired vision in the field seemed (to finger test) decidedly larger than at the former examination.

The obliterated artery in the R. was unaltered, and in the L. a similar vessel was now noticed for the first time, though it had very likely been present at the former examination. A large and very tortuous vessel ran near to, though not alongside of, the obliterated artery in each eye. In the R. this was certainly an artery (because the companion vein of the obliterated artery was visible close to that vessel); it became *larger* towards the periphery, and at the extreme visible limit of the ophthalmoscopic field it seemed as if about to join the termination of the "obliterated" artery, which here was of full size, and had lost its white sheath (or thickened coat). In the L. this tortuous vessel, also an artery, was connected on the disc with a network of small tortuous vessels, evidently arterioles dilated for collateral circulation.

The presence of a single enlarged tortuous artery, evidently dilated in order to compensate, is extremely unusual in the retina. In the R. this artery corresponded roughly with the seeing area; in the L. I have not noted its position. The presence of this artery in each eye was probably due to some peculiarity in the origin or mode of branching of the arteria centralis, and probably accounted for the vision remaining in a part of each field.

Mrs. B. rapidly became worse in health, got very dyspeptic, suffered from feverish attacks (I understood with rise of temperature), and died about the end of September. No *post mortem* was allowed.

The questions in this case are:—

Why did the renal disease cause arterial plugging and not the ordinary albuminuric retinitis?

Why did no other arteries become plugged?

Was there anything peculiar about the renal disease?

Why did she retain intact an exactly symmetrical portion of each visual field?

Heart Disease; Attack of Severe Giddiness, Vomiting, and Prostration; Retinal Embolism three days later.

Mr. C. (P. 8, 117), æt. 27, tall, strong, very muscular, and fond of football and violent exercise. On April 28th, 1883, after some exertion, the details of which I have not noted, he became very giddy for several hours and vomited freely. Afterwards he felt much prostrated. On the evening of May 1st, when he got up to go to bed, he found that the upper half of the sight of his L. eye was obscured. He had been for a drive, facing the east wind the same afternoon.

I saw him on May 7th. He was still feeling rather giddy, and had an uncomfortable feeling in his head, referred to the L. parietal region. There was no deafness. Acuteness of sight was normal in each eye, but the upper part (almost the half) of the field of the L. was blind. There was dense white haze of the lower half of the retina (more properly the lower half of the yellow-spot region) of the character usual in embolism, with enlargement of the minute vessels. The retinal arteries, even those supplying the inflamed area, were of full size. Owing to the haze I could not feel sure whether the branches supplying the diseased area pulsated on pressure, but those going to the non-affected parts did pulsate easily. No hæmorrhages.

He had not had rheumatic fever, but Dr. Gowers found "considerable aortic disease and secondary mitral regurgitation."

What was the nature of his attack of giddiness and vomiting; and in what relation did it stand to the retinal embolism?

Repeated Attacks of Failure of Sight during several days in both Eyes, ending in almost complete Blindness with appearances of Retinal Vascular Blocking. Influence of Posture. Probably Thrombosis of both Retinal Arteries excited by feeble Circulation with diseased Vessels.

Geo. McDonald (I. P., T., 1884, No. 27), a wheelwright, æt. 78, was going for a walk on the evening of Jan. 29, 1884, when he "felt faint," all the gas-lights "turned blue," and he had to hold on to the railing; he got to a friend's house near, rested for half an hour, and then felt well and saw the lights clear and of the proper colour. Next morning (30th) at about 10 o'clock his sight became foggy, so that he "thought there was an eclipse," and gradually faded until he could not see the light of the fire in the grate; he then lay down in bed for a couple of hours, and on getting up could again see pretty well, but the sight got worse again towards night. For the next four or five days the sight varied, but on the whole got worse, until by Feb. 6th he was as blind as when he was brought to the hospital two days later (8th).

On admission (Feb. 8th).—He could see fingers badly at 6" with the R. eye; p. $5\frac{1}{2}$ mm., and nearly motionless; ophth.,—slight, diffused haze of retina, o. d. rather pale, retinal vessels about normal in size, and pulsation easily produced in the arteries, no hæmorrhages. L. eye; no p.l.; p. $5\frac{1}{2}$ mm.; ophth.,—retina more hazy than in R. so that the fovea centralis was apparent as a red spot, retinal arteries of normal size, but neither pulsate nor empty on pressure, the upper main vein almost empty on o. d. but beyond o. d. full though too small, lower main vein shows a broken blood column the movements of which can be easily seen near the o. d.

He is a spare, sallow, wizened old man, feeble but intelligent. Arteries tortuous and their walls very hard; heart sounds and impulse feeble but no bruit; lungs emphysematous; urine free from albumen and sugar, sp. gr. 1027; he was formerly a heavy drinker, chiefly of beer, and never went a week without getting drunk. He has always been in the habit of going without food from breakfast till dinner at 4 o'clock, and he still does so; during the last 12 months he has several times come home feeling very faint apparently from want of food.

He was taken in and kept in bed, on his back, for about 10 days. V. in the R. improved a little during the first few days (on 10th V. of R. = fingers at 3', and on 14th the same at 3' to 4'), but after that remained stationary.

A few days after admission the veins in the L. regained their natural size and appearance.

On March 6th, the date of the last note, vision was about the same and he could see a letter or two of 20 J.; there was little, if any, haze of retina in either eye, the retinal vessels were of normal size, and the discs rather, but not very, pale.

*Chronic Iritis with (?) Node in Cornea many years after
Syphilitic Infection.*

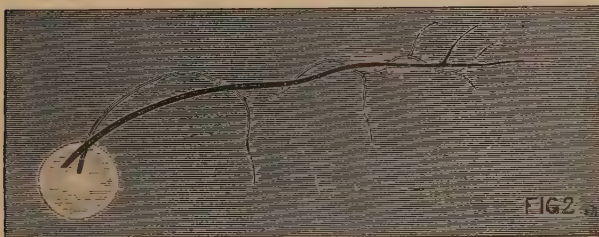
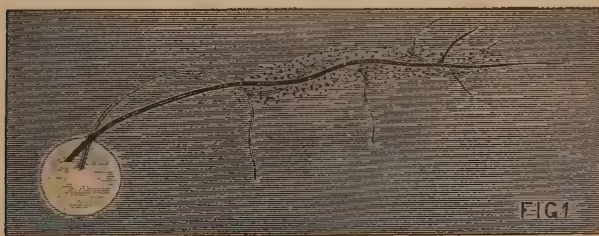
Anne S., æt. 54 (Moorfields, 2, 48), came to Moorfields in March, 1886, with subacute iritis in the right eye of a fortnight's duration; ciliary congestion, a single synechia, T.n. She attended regularly without marked change until September 8th, using atropine and taking a little iodide of potassium. At that date I noticed a round whitish deposit in the cornea, just below the centre and apparently in the deeper layers, 2 mm. wide; there were two other and less defined spots; the iris had become fleshy, and several lymph synechiæ had formed. The patch was unlike anything that I recollected to have seen in the cornea, and thinking it might be a node we went carefully into the history. The patient had been married twice. By the first husband, who died 20 years ago of "consumption," there were eight children; 1st living, 2nd stillborn, 5 died between five and nine months, having had eruptions on hands, arms, and thighs; 1 was killed. By second husband, whom she married 18 years ago, four children, three are living, one died at 16 months of measles. She has had neither rheumatism or gout. Ten years ago she was under Mr. Wordsworth's care for double sight, and on his letter we found the diagnosis "paralysis of right external rectus." As it therefore seemed certain that she was syphilitic, she was ordered larger doses of iodide with small doses of blue pill and perchloride of mercury. On September 29 the corneal deposit was unaltered, and there were two buff-coloured deposits in the lower part of the angle between cornea and iris, as in bad cases of keratitis punctata, but no small dots could be made out

either now or at previous examinations: the treatment was continued, and upon November 10 the deposit in the cornea and those in the angle had entirely disappeared.

Single large Retinal Hæmorrhage from Retching. Much Pigment left around the Vessel implicated for more than a year. Subsequently complete Absorption of the Pigment.

Mr. S. (P. 4, p. 10) aged about 35, a medical man, on getting up one morning, about a year before I saw him, was very violently sick, and at once found a large blot in the lower part of the left field, so that when he looked straight forwards he could not see a cigar held at the left side of his mouth, the right eye being shut; the defect passed away in the course of three or four months. He came to me with asthenopia from over-drawing, &c., having suffered from it for two years, and the left eye being always the more troublesome; his circulation was excitable and his tone low.

When I saw him in Jan., 1880, I found in the L. eye the changes which are half diagrammatically represented in Fig. 1. The main artery and vein passing upwards and outwards ran close together, the artery being the more tortuous of the two. These two vessels were very thickly set along a considerable



tract by fine pigment granules which began at about two disc breadths from the disc; they lay to a great extent in front of the vessels, but not so thickly as to quite obscure them; amongst the pigment dots were a few bright highly reflecting ones; excepting that the artery was tortuous the two vessels looked quite healthy. I examined the eye again nearly six years later (Dec. 1885); by the most careful scrutiny I now could find no trace of the pigment,—nothing but a few bright white dots running along the vein; as shown in Fig. 2, the artery was as tortuous as before.

I should add that the pigment dots seen at the first examination were black.

Change in the Colour of Healthy Irises.

Mrs. F. brought me her son (P. 3, p. 145), æt. 14, in 1879, for myopia of about 10 D.

His mother told me, without being asked, that his eyes (irides) had changed colour; they were now of a uniform greenish-grey without spots; she said "they used to be dark brown and are now quite different."

The boy had dark crisp hair and dark skin; his features also were suggestive of a strain of African blood.

Another case is that of a young lady æt. 23 (P. 6, p. 126). The iris of the left eye, after passing through a long attack of chronic irido-cyclitis, was found to be uniformly grey, the other one which had not been diseased being brown, she was quite sure that the two irides had been alike, but for this I had only her statement. In this as in the last case there was some myopia, more in the diseased eye.

ON SYMPATHETIC INFLAMMATION OF THE EYEBALL.

By R. MARCUS GUNN, M.A., M.B.,
Assistant Surgeon to the Hospital.

(Continued from p. 102.)

As previously mentioned, I am indebted to Dr. Brailey for the pathological notes on the enucleated eyeballs.

CASE XXI.—*Severe Sympathetic Ophthalmitis following the Operation of Iridodesis. Iridectomy and later Cataract Extraction on Sympathising Eye. Result fairly good.*

Alice S., æt. 11. Admitted June 20, 1878.

Was treated here four years ago. The in-patient notes of that date are, "April 24, 1874, lamellar cataract both. Iridodesis in left. Discharged April 29, progressing favourably."

The *left* eye has been inflamed almost ever since this operation. There is now a small cystoid cicatrix near inner corneal margin at the position of the iridodesis. Iris adherent to cornea at periphery. ? Barest perception of light. + T. 1? *Right* eye, pupil excluded; anterior chamber very shallow; iris adherent to the cornea at several points near the periphery. Distinguishes hand-reflex in outer part of field. + T. 1? Atropine has no effect on either iris. 20. *Right*. Iridectomy upwards, July 1. *Right*. T.n. Counts fingers at 6 inches in outer part of field. Discharged.

Re-admitted November 11, 1878. The right eye has remained quiet. 12. *Right*. Linear corneal incision upwards, and lens extracted; it was porridgy in consistence, and came away piecemeal. A little soft matter left in pupil. December 12. Pupil of good size, but has opaque membrane in it. Discharged.

Examined June 11, 1884. Eyes look quiet, but they are both very tender to the touch, especially the left. *Right*. Pupil slightly drawn upwards, occupied by a little opaque lens substance and membrane. T.n., but full. There is barely any

fundus reflex with ophthalmoscope. With +9 D. V. = $\frac{20}{100}$, and with +13 D. sees letters of Jaeger 12. (She is almost quite illiterate, and was tested with illiterate type.) *Left eye.* + T. 1? Counts fingers at 10 inches.

CASE XXII.—*Wound in Ciliary Region, followed after some Weeks by Sympathetic Inflammation of a Mild Type. Excision. Result good.*

William E., 34. Admitted Nov. 21, 1878.

His *left eye* was struck by an iron rivet 11 or 12 weeks ago. There has been a wound of cornea and ciliary region down and in, leaving a puckered scar. Pupil fairly active to light, but the iris is lustreless, and evidently slightly inflamed. Counts fingers at 1 foot. *Right eye.* Sympathetic iritis of mild type. Pupil responds fairly to light. There has been a slight effusion of lymph at edge of pupil. V. = $\frac{20}{30}$, and Jaeger 1.

The left eye was excised immediately on admission. Ordered atropine drops six times daily to right eye, and to wear a black bandage. Dec. 4. Pupil well dilated. There is a ring of dots of uvea on anterior capsule, where the iris has been slightly adherent. T.n. V. = $\frac{20}{40}$ fairly, with + 50" sph. $\frac{20}{20}$ partly. Discharged.

Pathological Examination.—Eye of about normal size. T. —1. A. c. shallow; slight haze of cornea near wound, which is at the lower periphery, extending into ciliary region. *On equatorial section* a good deal of syrupy, slightly yellowish fluid escaped. The vitreous is shrunk and detached from its posterior attachments as far as the ciliary body. The fundus is generally of a dull dark purplish colour, with a superficial whitish haze, which is most marked in the neighbourhood of the optic disc, which is a little swollen, and slightly redder than usual; its margins are hazy, especially above and below. The haze extends rather further along the course of the retinal vessels. The y.s. is a small dark point in a hazy whitish-purple area.

In the anterior half of the globe the vitreous remains in

situ. On the lowermost part of the ciliary processes is a dense bluish-white partly fibrous layer, which extends into the vitreous as well as on to the adjacent lens margin. Its contraction has drawn up the lower part of the retina away from the choroid into a prominent fold. Elsewhere the ciliary processes appear normal. The lens is somewhat yellowish, but transparent. Near the centre of its posterior surface is a blood stain.

Microscopical Examination.—Sections of the upper ciliary region show the fibres of the ciliary muscle to be normal in size and disposition, and the iris to be a little inflamed, though not thickened. In the lower ciliary region the iris is absent, and its place is occupied by much fibrous tissue, which extends from the edges of the wound into the corresponding part of the anterior chamber and internal surface of the ciliary body. The choroid shows in places well-marked and well-defined clusters of inflammatory cells which occupy its central strata. The optic nerve is healthy, except that an excess of nuclei is seen between its sheaths and around the blood-vessels in the optic papilla. The lamina cribrosa is not pushed back.

CASE XXIII.—*One Eye Lost from Injury. Sympathetic Inflammation eleven years later, apparently induced by Superficial Irritation from Foreign Body. Result Unfavourable.*

Edwin J. B., 31. Admitted May 7, 1878.

Left eye injured 15 years ago by a hailstone, and was afterwards "blind." Excised elsewhere four years ago.

Right eye was irritated by a small foreign body four years ago, shortly before the excision of the left, and the redness continued for a long time. The pupil is now excluded and occluded, and the iris bulging forward. — T. 3. Barest perception of light.

It seems probable that the left was excised on account of the symptoms then in the right, and that the redness mentioned was really in association with sympathetic inflammation.

CASE XXIV.—*Sympathetic Irritation following a Blow. A Second Injury to Exciting Eye two months later, quickly followed by Sympathetic Inflammation. Excision of Exciting, Recovery of Sympathising Eye.*

John R., 48. Admitted June 5, 1878.

Left eye. Injured last March, by a piece of wood striking it while he was engaged chopping. He had very little pain until three weeks ago, when it was hit by a man's elbow. Since then it has been painful. Has now bare perception of hand-reflex. The *right eye* used to fret and weep when the left was sore. About 16 days ago it began to get dim and itch. *Left.* Excised immediately on admission. 6. *Right.* Pupil sluggish. T.n. Ciliary injection, especially below. Fine posterior synechiæ. $V. = \frac{20}{40}$ fairly, with $- 40''$ sph. $= \frac{20}{20}$ almost perfectly.

Ordered atropine drops frequently, to wear a dark bandage, and to take a mercurial. 22. Has had severe pain on one or two occasions during the night. Pupil has been widely and uniformly dilated for the last week. The gums are slightly touched.

July 5. No injection. A circle of uvea on anterior capsule, showing where the contracted pupil was adherent. $V. = \frac{20}{20}$ barely, with $+ 60''$ sph. Ophthalmoscope shows the disc to be injected with a hazy inner margin. Venous pulse. T.n., but low. Discharged to-day.

He was not again examined, and died a few years later.

Pathological Examination.—The globe appears of normal size and shape. The iris to the naked eye does not appear thickened. The pupil is small, elongated transversely, and displaced outwards. The posterior synechia involves only the pupillary margin below, but in other parts the whole posterior iris surface is adherent. *Equatorial Section:*—The vitreous is clear. The substance of the lens is clear; on its posterior surface near and extending up to its outer margin is a small area, opaque from a deposit of lymph, which extends also on to the adjacent ciliary folds for about one-half of their length. The attenuated apices of these folds are adherent to the lymph on the lens margin, being apparently under some tension. The eye appears normal in other respects.

CASE XXV.—*Incised Wound of Eyeball, followed by Sympathetic Inflammation two months later. Periodic Attacks of Pain and Dimness for many years. Slight Improvement after Excision of the Injured and Iridectomy on the Sympathising Eye.*

Valgerdur J., 20. Admitted Jan. 4, 1878.

Right eye was injured and rendered sightless when she was six years old by her falling upon a knife. It was excised here three years ago. (No notes can be found.) The left eye was first affected about two months after the accident; there was then pain and dimness. She could not see for some time. Ever since then she has had occasional attacks of dimness with pain, less frequently since the removal of the right. She used to have them about twice a year. Shortly after the excision she had an attack, and another 21 months ago. The present attack came next, and began three weeks ago. She has had pain in the eye and vertex, and "neuralgia" in the supra-orbital region, and behind the corresponding ear. The neuralgia has been getting better for the last two days, but the pain in the back of the eye continues. No toothache. In the last year her catamenia have been very irregular, and she has had leucorrhœa. Better again for the last two months.

Left eye. Punctate keratitis. Pupil irregular; small coloboma inwards, result of an iridectomy three weeks after excision. T.n., but full. Counts fingers at 2 feet. Ordered belladonna fomentation, atropine drops, and Heurteloup's leech to temple. 7. More pain in eyeball. Complains that "everything looks red." 21. Has had one or two attacks of pain in eyeball and cheek, generally relieved by Heurteloup. 23. Has rubeola. Transferred to another hospital.

On convalescence she returned to her native island of Iceland. In March, 1884, she writes to friends in London that she has had very bad neuralgia in the left eye all winter, which has left it very weak.

Examined April 7, 1885. Has recently returned to England. While at home since last examination she has had two attacks of ocular inflammation, with an interval of about three years between them. The attack begins with pain in the left side of the face and head, and then the eye becomes affected. She is liable to slight attacks of pain in the head from cold.

There is now a slight greyish nebula of the cornea near its lower margin. The anterior chamber is of good depth, and the iris looks normal in lustre. Anterior ciliary vessels slightly enlarged. Many posterior synechiæ; slight opaque film of organised lymph in centre of pupil, with uvea over part of it. Good artificial coloboma inwards. The periphery of the lens is clear, but centrally there is a slight haze, like that of zonular cataract. (She says, however, that her sight was quite good before the injury; while there is no history of convulsions, and her teeth have sound enamel.) Iris reacts feebly to light. T.n., but rather low. $V. = \frac{8}{200}$; $c - 3.75 D. = \frac{20}{200}$. Reads Jaeger 6 at 6 inches.

Re-admitted to hospital June 13, 1885. The eye became painful a day or two ago. There is very slight general congestion of the globe, with recent keratitis punctata downwards and centrally. T.n. Reads Jaeger 16. Ordered Heurteloup's leech to the temple; atropine drops; warm collyria; arsenic internally. To wear dark glasses.

July 2. No injection now. Cornea clearing. 16. Cornea much clearer. Discharged.

Re-admitted July 30. Recurrence of pain. There is no injection. There is fresh keratitis punctata. T.n. Reads Jaeger 16. Treatment as before. Aug. 29. Discharged.

Examined May 6, 1886. The eye has been quite quiet for the last three months or so; it gradually got stronger after leaving the hospital. Diffuse haze in the lower part of the cornea. No details of the fundus visible on account of the lenticular opacity. T.n. $V. c - 2.5 D = \frac{20}{100}$ partly. Reads words of Jaeger 4 at 4".

CASE XXVI.—*Wound with Prolapse of Iris. Operation performed two months later. Sympathetic Inflammation soon followed this Operation. Excision of Injured Eye. Useful Vision retained in the Sympathising Eye.*

Ann A., 18. Admitted Dec. 31, 1877.

Left eye. Wounded 11 months ago by the latch of a door. Two months later she says an operation was done on this eye (under anæsthetic), but its nature cannot be determined, as no

notes can be found; it probably consisted in cutting off a prolapse of iris. The *right* eye began to be dim-sighted nine days after this operation, with lacrymation and photophobia. There never has been pain in it.

Left. Cicatrix at lower outer margin of cornea with pupil drawn down to it. Iris lustreless and woolly; marked ciliary injection. —T. 1. Entropion of lower lid, apparently the result of the photophobia.

Right. Iris lustreless. Pupil small and inactive, with numerous adhesions to lens capsule. —T. 1? V. = fingers at 5 feet or more. Intense photophobia. *Left.* Excised. Ordered atropine drops frequently to right. Dark bandage.

Jan. 3, 1878. The pupil has not yet dilated at all. Thin layer of lymph over pupillary urea. Fundus fairly well illuminated, but the eye is too irritable to bear prolonged examination. Counts fingers at 14 feet. 7. Discharged.

No further notes could be obtained.

Pathological Examination.—Globe somewhat shrunken, and rather squared. Antero-posterior measurement, 21 mm.; lat., 23 mm.; vert., 21.5 mm. —T. $1\frac{1}{2}$; marked ciliary injection. Cornea clear. Anterior chamber extremely shallow. Pupil displaced to extreme lower and outer side, and blocked by whitish-grey opaque lymph. The iris appears woolly, and coarsely striated radially. *Equatorial Section:*—The sclerotic measures in thickness at its upper equator 0.7 mm.; at outer, 0.5; inner, 0.6; lower, 0.8 mm. The vitreous appears to be replaced entirely by a thin, slightly yellowish fluid. The optic disc is rather swollen at its edges, from which a slight greyish-white radiating opacity gradually shades off into the surrounding retina. It shows a small central depression, with overhanging margin. A small fold of retinal detachment extends from the upper part of the disc to the yellow spot. The lens is *in situ*, and clear, except that on its posterior capsule, all but its central part, is a bluish-white opaque layer, which extends on to the adjacent anterior half of the ciliary zone. This layer extends furthest and is thickest below and outwards, corresponding to the position of the displaced pupil. The central ciliary zone is generally deficient in pigment. The zone just behind the ora serrata is of a brownish-grey colour, being very finely speckled, with minute greyish atrophic dots. The posterior part of the fundus is of a more brown-red than normal.

CASE XXVII.—*Cataract Extraction, followed by Inflammation and Ultimate Shrinking. Sympathetic Ophthalmitis three months after the Operation. Excision of Lost Eye. Iridectomy, and subsequently Extraction and Iridotomy in Sympathising Eye with Good Result.*

George S., 62. Admitted Nov. 27, 1876.

Left eye. An immature cataract was removed elsewhere on Feb. 23 last. Inflammation followed. On June 1 he was admitted into Moorfields. The left eye was then atrophied and sightless, and the *right* eye had been inflamed for nine days with pain, ciliary injection, and sluggish pupil. The left was at that time excised, and an iridectomy upwards done in the right, leaving a good coloboma. This eye became stronger for a few days after the iridectomy, and he soon left the hospital. About a week after returning home, he was seized with severe pain in the right eye and temple. On Sept. 7 he was again admitted into this hospital. The notes then are, "*Right, sympathetic iritis. + T. 1. Cataract. V. = hand-reflex. Curette extraction, and a little of the capsule removed by forceps. Sept. 29. Counts fingers at 4 inches. — T. 1. Discharged.*"

The coloboma is now filled with lymph. *V. = bare perception of shadows. — T. 1 ? 28. Incision made from outer side with Taylor's knife, and the lymph cut through with it. Weiss's scissors then used to enlarge the opening. Dec. 8. Doing well. Counts fingers at about 2 feet. Dec. 23. With + 3½" sph. V. = $\frac{10}{200}$; with + 2" reads Jaeger 16. Discharged.*

April 17, 1877. With + 8" cyl. axis 30° down and out from vertical and + 4" sph. *V. = $\frac{20}{200}$; with same cylinder and + 2" sph. reads Jaeger 6 slowly.*

On May 28, 1884. He was able to do his farm work, go to market, &c.

Pathological Examination.—The eye is shrunken. The cornea is thicker than usual, and especially above in the neighbourhood of the scar of the cataract extraction. The sclerotic just behind the scar is drawn in very markedly, so as to make a rather deep groove, which is most conspicuous at the upper and inner part. The iris is also clearly adherent to the scar. On antero-

posterior vertical section a yellowish turbid fluid escaped. The retina is detached except from the optic disc and its ciliary attachments, though it is not much contracted. The sclerotic is very thick behind, and also rather thicker than normal throughout the greater part of the rest of its extent. The anterior chamber is reduced to a mere chink. A whitish-grey layer of lymph is seen on the anterior surface of the iris. The pupil is occluded. The ciliary processes are stretched away from the sclerotic *below*, towards the axis of the eye, but the external layer of the ciliary body still retains its normal position in relation to the sclerotic. The consequence is that the lower part of the ciliary body, as seen in meridional section, is extended so as to occupy several times its normal thickness. The sclerotic on this side suddenly becomes extremely thin at the insertion of the inferior rectus, and the thinning extends forwards as far as the corneal margin. In the upper ciliary region there is a similar traction of the ciliary processes towards the axis of the globe, so that here the ciliary body is also extended in an exactly similar manner, though by no means to so great an extent. This stretching of the ciliary body seems as if it had been produced by the contraction of the retina drawing on its anterior attachment. The most anterior part of the operation wound seems a little in front of the line of the sclero-corneal junction.

CASE XXVIII.—*Cataract Extraction followed by late Panophthalmitis. Severe Sympathetic Inflammation, but Date of Onset Unknown.*

Henry C., 79. Admitted Dec. 23, 1877.

Left. Panophthalmitis with gaping wound below, through which the iris is protruding. Had cataract extraction performed elsewhere, about a year ago. The result was bad at the time. There has been slight pain ever since.

Right. His sight began gradually to fail six years ago, doubtless from cataract. Has had no pain, and it is impossible to say when inflammation commenced. He was examined here before the removal of the left cataract, and there was then no note of iritis, but only of cataract in both. The cornea is now steamy. + T. 2. Pupil excluded. Bare perception of light.

Jan. 1, 1878. Left excised. Discharged Jan. 5.

No further information could be obtained.

Pathological Examination.—The globe is collapsed. It was opened at the optic nerve entrance during the excision. Just inside the lower corneal margin the incision of the cataract extraction is visible. *Equatorial Section* :—The sclerotic appears to be of greatly increased rigidity. Its apparent thickness is greatly added to by a tough closely adherent rather gelatinous-looking layer. This appearance is due to an infiltration of albuminous substance into the thin connective tissue layer, which normally clothes its external surface. A cavity the size of a pea, with thick walls, is visible at the lower and inner part of the section. In this is contained a pale reddish-brown fluid, intermixed with some soft shreds of a purulent appearance. This cavity is apparently that of the detached retina. The space between this layer and the sclerotic is entirely filled up as to its peripheral half by a greyish translucent tough substance, apparently the vastly thickened choroid, and, internally to this, by a reddish semi-solid substance, probably the remains of blood, exuded between choroid and retina. Scarcely any remains of a pigment layer can be traced in the position of the retinal pigment epithelium. A vertical antero-posterior section of the anterior half of the globe shows the iris much thickened. In front it is in contact with the cornea. A pinkish-red layer is seen on and closely adherent to its posterior surface, the two being separated by a slightly irregular black pigment line. Further back again, is a whitish-yellow purulent mass, evidently the remains of the shrunken and suppurated vitreous.

CASE XXIX.—*Severe Sympathetic Inflammation about four years after an Injury of the other Eye. Excision of the Exciting Eye. Result Unfavourable.*

Wm. S., æt. 61. Admitted Jan. 17, 1879.

Right eye. Injured by a blow with a candlestick four or five years ago. It has been blind ever since. About four months ago this eye was struck with a piece of coal. The centre of the cornea has since given way from ulceration; the lens was found lying partly out of the aperture some days ago, and removed. *Left eye.* The sight began to fail about six months ago; it was then inflamed and painful. *Right.* Globe somewhat shrunken.

There is a round hole in centre of cornea, as if a piece had been punched out. Purolymph at bottom of a. c. No perception of light. — T.n? *Left.* Much conjunctival and ciliary injection. Central circumscribed haze of cornea. Pupil excluded and occluded by dense layer of lymph. V. = bare perception of hand-reflex. + T. 1. 18. *Right.* Excised. 22. *Left.* Pain very slight. Gutt. Atrop. ordered. 24. Small dark coagulated ecchymosis from small superficial vessels on upper corneal periphery.

Feb. 1. Much pain. Heurteloup. 13. The eye is getting steadily worse. There is a yellowish-grey deposit of purolymph at the lower outer part of the a. c. (He sleeps on his left side.) Still considerable pain. V. = hand-reflex barely. Is having mercurials now.

March 31. The eye has been very painful yesterday and today. The purolymph has gradually contracted from the rest of the chamber into the pupil, where there is a large dense lump. There are still small flocculi of deposit on the posterior surface of the cornea down and out and below.

April 14. Much pain again for the last two days; almost sleepless. There is more purolymph in upper part of a. c. Much lacerimation.

May 10. Globe very tender. Much injection. Much pus in a. c. and cornea. Barest perception of light. Discharged.

Pathological Examination.—The globe is rather soft. — T. 1. Its measurements are:—Antero-posterior, 22.5 mm.; lateral, 24 mm.; vertical, 25 mm. The cornea is quite flat, except at its centre, where there is an aperture forming a pit, the depth of which is apparently much greater than the corneal thickness, and through which a smallish flattened globular body, apparently the lens nucleus, escaped some days ago. The cornea bordering on this hole is whitish, semi-opaque, and vascular, but its more peripheral part is clearer. *Equatorial Section:*—The sclerotic is seen to be less rigid than usual, and of normal thickness. The retina, soft and detached from its posterior connections, lies on and defines posteriorly a translucent mass, which clothes the posterior lens capsule and the ciliary processes. In the centre of the anterior part of this mass is a white cheesy substance, containing some particles which are hard and apparently calcareous, the whole being apparently the remains

of an abscess in the vitreous. This extends right up to the depression in the corneal centre. The margins of this depression are much pulled in, as if under considerable traction from within. The rest of the cornea has the iris closely in relation with its posterior surface as far as the perforation, where the iris comes into relation also with the cheesy mass. Between the choroid and retina is a thin yellowish-brown fluid. The ciliary body is tough and much thickened, as if by infiltration with some semi-translucent substance. The same change affects the anterior part of the choroid, whereas further back this tunic is normal.

Microscopically the changes in iris, ciliary body, and choroid consist in infiltration of their tissue with inflammatory cells collected in groups. Similar cells are exuded on their internal surfaces. These cells are partially organised into tough connective tissue.

CASE XXX.—*Severe Sympathetic Ophthalmitis several months after Cataract Extraction in other Eye. Loss and Excision of Sympathising Eye, Exciting Eye remaining Quiet, with Good Vision.*

James W., æt. 77. Admitted July 23, 1879.

Right eye. Modified Graefe cataract extraction here in July, 1878. The lens was hard and large, but came away well. Slight bleeding into a. c. Severe iritis followed, with recurrence of bleeding into a. c., and ultimately hypopyon. *Left eye* has been inflamed and painful for last two months; worse during last three weeks. *Right.* Conjunctiva clear and uninjected, and eye perfectly quiet. Good pupil. T.n. V. is good; with correction = $\frac{20}{30}$ fairly, and J. 1 fluently. *Left.* Conjunctival and ciliary injection. Superficial haze of cornea; loss of epithelium over lower half. Pupil quite excluded and occluded. Iris slightly bulging. No perception of light. + T. 2. *Left* excised.

Discharged July 29.

Pathological Examination.—There is a conjunctival and ciliary injection, with superficial haze over the lower half of the cornea. The pupil is excluded and occluded. The tension is increased (T. + 2). *Equatorial Section*;—The sclerotic is of

normal thickness. The vitreous forms a slightly tough transparent mass, adherent to the posterior surface of the ciliary processes and lens. The retina is *in situ*, though it is apparently not at all adherent to the choroid. The optic disc is slightly depressed, and is surrounded with an area of retinal haze. The lens is *in situ* and opaque. The iris is adherent to its anterior capsule, except near its periphery, where it is bulged forwards, as if by a pressure of fluid from behind. The iris tissue is inflamed, but not materially thickened. It contains in its interior no marked groups of inflammatory cells, as is usually the case in eyes that have *excited* sympathetic disease. Nor is there any exudation behind its uveal pigment layer, or on the internal surface of the ciliary body.

CASE XXXI.—*Corneal Ulceration leading to Perforation and Anterior Synechia. Recurrent Attacks of Pain. Sympathetic Inflammation some months later. Improvement after Excision of Exciting Eye.*

John A., 52. Admitted Jan. 4, 1879.

A tall thin man, with brown hair and bluish-grey irides. No personal history of syphilis, rheumatism, or gout. He served in the army in India from 1862 till 1873. Health has been bad. In July last the left eye was inflamed and painful, seemingly a corneal abscess. This continued for three or four weeks, and since then he has had pain on and off. About the end of November the right eye became red and painful; there was lacrymation and photophobia. The sight has been getting gradually worse ever since.

Left eye. Globe somewhat shrunk and injected. Large vascular leucoma, with extensive anterior synechia; anterior chamber shallow. V. = barest perception of light. — T. 1. *Right eye.* Injection of conjunctiva and of ciliary region. Keratitis punctata. The pupil dilates fairly well under atropine; one posterior synechia up and in, and much uvea in small dots on anterior lens capsule. Fundus seems normal. V. = Jaeger 19 with difficulty, and counts fingers at about 3 feet. T.n. He complains of much pain in right temple. Ordered atropine drops, iodide of potassium mixture, and blister behind right ear. To wear dark bandage. 8. Improved. *Right.*

Pupil dilating well and less injection. 15. *Right*. V. is worse. The keratitis punctata has increased. *Left*. Excised. 23. *Right*. V. improved, now = $\frac{20}{200}$; counts fingers at 12 feet. Discharged.

No further notes could be obtained.

Pathological Examination.—The eye is soft (T. — 1), and slightly shrunken, its measurements being—Antero-posterior diameter, 22·5 mm.; lateral, 24·5 mm.; vertical, 23 mm. The cornea is rather small. It is occupied by large, white, not very dense leucoma, except *below and internally* where there is a clear patch with visible iris, and *above and outwards* where is a similar though smaller and less clear area. *Equatorial Section*:—The sclerotic seems about normal. The vitreous is shrunken to a small, yellowish, translucent globe on the ciliary processes and lens area, and from it to the optic disc there extends a narrow peduncular portion. Between these vitreous remains and the choroid is a thin, yellowish, clear fluid. The lens is *in situ*. It has a hard nucleus and much peripheral soft matter. The iris is universally adherent to the cornea. There is an exudation of lymph behind it and on the anterior portion of the ciliary circle, especially below where it extends, gradually thinning in its course, backwards to the ora serrata. This lymph is of a dirty white colour with a slight greenish tinge. It is dense and, apparently, not purulent in character. The optic disc is hazy and similar haze is seen at the yellow spot. Its blood-vessels are small.

Microscopically the iris is much thickened, adherent to the cornea at its centre but free at its periphery. Characteristic groups of inflammatory cells are seen in it, the ciliary body and the choroid. Inflammatory exudation, partly organised into tough connective tissue, clothes the posterior iris surface and the internal aspect of the ciliary body.

CASE XXXII.—*Severe Sympathetic Inflammation occurring three weeks after an injury to the other Eye. Excision of the Exciting Eye. Result Unfavourable.*

Elizabeth D., 35, admitted March 10, 1879.

A dark-haired Irishwoman of nervous temperament. General history unimportant.

Right eye lost from a blow (tist or boot) about five years ago. For three weeks the sight of the left remained quite good, but then it was seized with severe pain accompanied by dimness of sight and coruscations. About five weeks later the right was excised. She has occasionally had severe pain across the forehead and in the left temple: it never lasts long. *Left*. Ciliary atrophy with marked engorgement of the ciliary vessels. There is a small ciliary staphyloma down and in. Cornea slightly nebulous. Anterior chamber shallow; peripheral adhesion of iris to cornea up and out. Pupil excluded and occluded. V. = bare perception of light. She has occasional flashes of light, "scarlet and blue and all colours." + T. 2. 11. Incision upwards: a small piece of iris removed piecemeal. 12. Atropine drops. 15. About one-sixth blood in anterior chamber. Ordered hot belladonna fomentation. 20. Blood almost gone. V = bare perception of light. Small coloboma above. T.n. Discharged.

CASE XXXIII.—*Shrunk Globe from old injury excised for Sympathetic Irritation. Iritis followed some time afterwards, probably sympathetic in nature. Iridectomy several years later with extraction of Cataractous Lens. Result fairly good.*

George B., æt. 58, admitted May 6, 1878.

The *left* eye was excised here about 13 years ago. Notes as follows: "Sept. 15, 1864. *Left* shrunk bulb after injury with stick 30 years ago. For last 18 months it has been painful on and off. *Right* feels very weak, but there is not the slightest redness. *Left* excised. Globe contained bone with pus on surface (?). 19. Discharged." He says the left was cut by a piece of broken stick. He saw for a week or two, but then the sight went away from this eye entirely. After the excision of the left he could see to do his work (as tailor) for some months, and he even did a little for some years, "but not like what I used to do." He had to take frequent rests. There is now a small nebula near the inner periphery of the cornea. No history of ulceration. The pupil is small, irregular, and acts imperfectly to light. Iris atrophic. T.n. V. = $\frac{3}{200}$, not improved by

spherical glasses : spells words of Jäger 19 at 4 inches. His sight varies from time to time he says, occasionally becoming very dim. Ordered atropine drops once daily. 8. No effect from atropine. Discharged May 14.

Re-admitted in April, 1884, when iridectomy was done as a preliminary to extraction of the then cataractous lens.

Examined May 24. Eye quiet. Good coloboma upwards. Lens cataractous. T.n. V. = hand-reflex barely.

Re-admitted June 20, 1884. Conjunctiva slightly injected; anterior chamber rather shallow. Pupil small, updrawn; coloboma upwards. Lens fully opaque; iris is rather bulged by lens, and is cribriform at lower part. T.n. V. = shadows. Projection good. 23. Extraction upwards through coloboma. Lens came away with difficulty and much soft matter was left behind. July 1. Pupil updrawn but clear. 11. V. $\bar{c}$ + 18 D. cannot decipher Jäger 20.

Re-admitted Oct. 8. Cornea slightly hazy at lower part. Pupil drawn up. T.n. V. $\bar{c}$ + 18 D. = Jäger 16. 10. Incision down and in with bent broad needle. Unsuccessful attempt to withdraw iris with forceps. Tyrrell's hook then introduced, and iridectomy down and in effected. Slight bleeding into anterior chamber. 13. Slight general injection. Good artificial pupil, but covered by thick membrane. V. $\bar{c}$ + 18 D. = Jäger 16. Discharged.

Examined April 21, 1886. Eye looks quiet and never troubles him now. T.n. Pupil large, overspread by membrane except below : through this gap the disc can be seen dimly and looks normal. No change seen in fundus. There are numerous opaque lines in the anterior part of the vitreous below the membrane. V. $\bar{c}$ + 18 D. = Jäger 16.

Examined Dec. 29, 1886. No family history of rheumatism. He never suffered from joint-pains previously to the sympathetic inflammation, but during the past year has had "rheumatic" pains in his feet and legs. His eye is *in statu quo*.

It is probable that a more thorough examination would have detected some evidence of sympathetic inflammation before the excision of the exciting eye.

CASE XXXIV.—*Prolapse of Iris following Corneal Section for Abscess. Sympathetic Irritation about six weeks later, and Excising Eye then Excised. Iritis first observed in Sympathising Eye four weeks after the Excision. Inflammation very severe, with great pain. Sclerotomy done for relief of Secondary Glaucoma. Ultimate Loss of Globe.*

Edward R., æt. 51. Admitted August 5, 1879.

About two months ago the left eye became inflamed and painful. No history of injury. He was in hospital last winter with rheumatic fever. His general health is rather feeble: has had loss of voice for many years.

Left. Large onyx down and out. *Right.* V. $\frac{20}{20}$. No Hm.

Left. Corneal section through onyx. Ordered hot fomentations and eserine drops. 10. *Left.* No a. c. Pain at times. 27. *Left.* Large prolapse of iris down and out. T.n. Considerable injection: no pain. V. = bare perception of light. Discharged.

Re-admitted September 25, 1879. For the last eight or nine days the right eye has been watery and dim-sighted; occasional aching pain in left.

Present condition. *Right* eye, photophobia, lacrymation, considerable injection. Cornea clear; good anterior chamber. Pupil rather widely dilated and sluggish (? partially under atropine). V. = $\frac{20}{20}$. No Hm. T.n. *Left* eye. Much injection.

Large prolapse of iris at old wound, rest of cornea slightly hazy. V. = Hand-reflex. — T. 26. *Left* excised. 27. *Right* pupil active. Complains of gumming of eyelids. To use astringent lotion. Oct. 2. Pupil active but oscillatory. Ciliary injection. Sight dim. Ordered atropine drops. 8. T. + ? 24. Much pain all last night. Iritis. Nov. 11. Posterior synechiæ forming (the atropine drops discontinued lately by surgeon's desire). Severe headache and morning sickness, with vomiting before breakfast. Nov. 21. Occasional attacks of severe pain, and morning sickness. Much conjunctival injection and gumming of eyelids. Dec. 16. For the last six weeks he has suffered much from severe headaches, chiefly in the right forehead, only relieved by subcutaneous injection of morphia.

23. Blisters and leeching have been tried without relief. Still much lacrymation and conjunctival injection. T. + ? Posterior synechia. V. = fingers at 9". Jan. 9, 1880. V. = fingers at 2 feet. 17 + T. 1 ? Has been feeling easier lately. Feb. 6. Has had no pain for five weeks; considerable bulging of iris; + T. 16. Severe pain in temple. Redness and bulging of iris increasing. + T. 1. March 4. Eye injected but not painful. + T. 1. Pupil semi-dilated. Complete exclusion of pupil with bulging of whole iris; anterior chamber deep in centre. V. = letters of Jaeger 20. 5. Sclerotomy upwards, but not far backwards. Slight bleeding into anterior chamber. 6. Iris flatter. T.n. Eye feels more comfortable. 15. T. + ? 18. Eye quiet. T. + ? Good anterior chamber with a little blood in it. Iris fairly flat, slight bulging to inner side. Counts fingers slowly at 5".

Discharged.

Examined April 7, 1886. The globe is now much shrunken and squared and has long been absolutely sightless.

Pathological Examination.—Globe normal in size and shape. The cornea exhibits near its lower and outer margin a brownish slightly prominent area corresponding to an interior synechia, as if the cornea had been necrosed and the exposed iris covered with but a very thin layer of organised and translucent lymph. Elsewhere the cornea is transparent, though it looks thin and somewhat irregular, with the iris apparently in contact with it throughout. *On equatorial section* the vitreous is clear and rather less consistent than usual. It separates *en masse*, though not very readily, from its posterior attachments to the optic disc and retina. The optic disc is somewhat indistinct at its margins; its blood-vessels are rather reduced in size, there is a hazy area between it and the *y. s.* which is indicated as a small brown spot. The lens is *in situ*; it is clear except an opaque area due to a thin layer of exudation on its anterior surface. The ciliary processes are not far from normal. Their apices are markedly grey. An irregular greyish band marks the posterior ciliary border. The intermediate part is brown (not black) and is slightly mottled with lighter brown dots and streaks. A vertical section of the anterior half of the globe shows the lens to be adherent to the iris and this to the cornea.

Microscopical Examination.—Meridional sections through the

inner ciliary region show the muscular fibres to be well developed. There is no enlargement of the larger arterial circle. The iris is much thickened by inflammatory cells which lie in its substance as well as behind and among the pigment of its scattered and atrophied uveal layer. Few blood-vessels are visible in the iris, but most of these have their endothelium considerably proliferated. The choroid shows numerous inflammatory cells disposed in groups which occupy its central strata, its blood-vessels are either distended by blood corpuscles or their lumen is partially or entirely blocked by a proliferation of the cells of the endothelium: their walls are thin. The O. D. is swollen. There is a slight increase of the nuclei around the blood-vessels at its centre. There may be slight inflammation of the optic nerve trunk.

CASE XXXV.—*Excision of Globe ten weeks after Perforating Wound. Subsequent severe Sympathetic Inflammation.*

Thomas M., æt. 9. Admitted Aug. 11, 1879.

Left eye injured in Nov., 1875, by falling on a piece of broken glass. The eyeball was removed elsewhere ten weeks later. The *right* was not affected before excision, but shortly afterwards this eye became inflamed.

The *right* eye has been painful since getting a blow upon it a day or two ago. Ciliary injection. Transverse opaque film across cornea, calcareous. Pupil excluded and occluded by dense layer of lymph. Sees hand-reflex. T.n. To have Gutt. Atrop. 18. Eye quiet now. Discharged.

This patient could not be traced again.

CASE XXXVI.—*Perforating Injury of Globe followed by severe Iritis. Excision eight weeks later. Sympathetic Inflammation, probably mild at date of Excision, but becoming severe three months later. Iridectomy. Result unfavourable.*

John H., 65, admitted May 22, 1879.

Right eye injured about eight weeks ago by the recoil of a branch of a thorn bush. The *left* has felt dim occasionally for some days with the appearance of a black speck moving before it. No pain nor photophobia. *Right*. Conjunctival and ciliary injection. Pupil excluded and occluded. +T. 1 or more.

No perception of light. *Left.* Ciliary injection. Pupil small, rather sluggish. Slight haze of middle of lens anteriorly,

(f) lymph on capsule. 22. *Right* excised. 26. *Left.* $V = \frac{20}{50}$

barely; not improved by sphericals. 30. $V. = \frac{20}{40}$. Discharged.

Re-admitted Aug. 28, 1879. He does not consider that the left eye was really affected while in hospital last, but a few days ago he "caught cold" in it. He had swelling of the glands in the left side of the neck, followed by pain in the eye and dimness of sight. He saw bright flashes of light, coloured blue and red. There is now keratitis punctata. +T. 2. Counts figures at 12 inches. Ordered atropine, grey powder, and iodide of potassium. Sept. 4. Iridectomy upwards. 5. T. still full. No pain. 12. T.n. Posterior synechiæ. Opacities in lens. Reads Jaeger 16, and not improved by a glass. 25. Considerable injection, chiefly ciliary. Oct. 2. Sight more dull this morning. +T. 1. Ordered eserine. 23. Sight improving. +T. 1 (?). Lens conjunctival redness. Reads small words of Jaeger 19. Discharged Oct. 23.

Re-admitted March 1, 1880. He has had a good deal of pain in left eye since discharge. Considerable injection, especially ciliary. Bulging of old iridectomy wound. +T. 1 or more. Has barely perception of light. Ordered belladonna fomentation. April 5. Eye much quieter. T.n. Cornea flattened. Shallow anterior chamber. Coloboma of former iridectomy filled with lymph. Cicatrix flatter, and iris more clearly visible. Discharged.

Examined May 4, 1886. Soon after leaving the hospital in 1880 the eye became inflamed and sight gradually left it. It is now shrunken and absolutely blind.

Pathological Examination.—The globe is of normal size. Its measurements are—antero-posterior, 25 mm.; lateral, 24 mm.; vertical, 24.5 mm. The iris is dull and slate-coloured. It is close to the cornea, and apparently thickened at its lower and outer part, but elsewhere the anterior chamber exists. The pupil is extremely small and occluded. *Equatorial Section.*—The sclerotic is of about normal thickness. The vitreous is turbid with greyish films and more dense flocculent

opacities. It is shrunken towards the ciliary body and posterior lens capsule, and separated by thin fluid from the retina behind. The optic disc is much swollen and opaque, the opacities extending into the surrounding retina. The blood-vessels from it are very small. The lens is *in situ* and opaque.

CASE XXXVII.—*One Eye lost from Inflammation following Gun-shot Injury. Sympathetic Inflammation of severe type setting in twenty years later, leading to great Impairment of Vision.*

Edwin S., 45, admitted Sept. 9, 1879.

The *right* eye was injured by a gun-shot wound more than 20 years ago. The eye was inflamed and very painful for about six weeks afterwards, and at the end of this time the sight of it was quite gone. The eyeball is now shrunken, but not painful. Eighteen months ago the *left* eye began to be troubled with muscæ, but there was no pain or redness until six months ago. Since this latter date his vision has become very bad. Cornea clear; anterior chamber of good depth; pupil occluded by layer of organised lymph; iris seems everywhere glued down completely to lens-capsule, and large vessels visible upon it, particularly above. T. slightly diminished. $V. = \frac{20}{0}$; reads

Jaeger 19 partly, $\bar{c} + 20''$ lens Jaeger 16. The right eye was excised on admission, and atropine drops ordered to the left.

Sept. 18. The pupil has dilated very slightly. $V. = \frac{20}{100}$ and

Jaeger 16. Ordered dark glasses. Discharged.

No further notes could be obtained.

CASE XXXVIII.—*Penetrating Wound of Eyeball followed by severe Sympathetic Inflammation six years later. Excision of Exciting Eye. Result unfavourable.*

Louisa C., 23, admitted Sept. 21, 1879.

Left eye injured by a perforating wound with the steel rib of an umbrella eight years ago. The *right* eye was first inflamed about two years ago. She has had several attacks since then, the last being about nine months ago. During the attack the sight is dim, and everything "dances before the eye;" occasionally there is severe headache in the vertex. *Left*. Conjun-

tival injection. Cornea clear. —T. 2. Bad perception of light. *Right*. Small dense leucoma in cornea outwards. Numerous posterior synechiæ. T.n. Reads Jaeger 12 at 5 inches. 29. *Left* excised. Oct. 1. Reads letters of Jaeger 6 at 3 inches. Occlusion and exclusion of pupil. Anterior chamber shallow. —T (?). Fundus reflex only. No superficial redness or pain. Discharged.

Examined Jan. 26, 1880. Vision same as on discharge.

Examined May 17, 1884. Since leaving the hospital she has had occasional pain and burning sensation in the eye. Four or five weeks ago a hæmorrhage occurred into the eye, and there are still remains of the blood-clot in the anterior chamber. Pupil excluded. Lens cataractous. —T. 1. V. = bare hand-reflex.

Pathological Examination.—The eye is soft (T. -2), though but little below the normal size, since all diameters = about 23·5 mm. The iris is dull and mottled irregularly with greyish-brown, this being due to an inflammatory change. The pupil is occluded with irregular margin. The anterior chamber exists. *Equatorial section* shows the retina *in situ* and the vitreous separated from it at the posterior pole by a little thin fluid, but otherwise clear and pretty normal. The optic disc is swollen, the choroid is mottled with darker red-brown and grey areas which are apparently due to choroiditis. The lens is *in situ*. It is semi-opaque, and of a yellowish-white colour.

CASE XXXIX.—*Lost Globe from Purulent Ophthalmia, and subsequent Injury by Blow. Severe Sympathetic Inflammation some months after the Injury. Excision of Exciting Eye. Result unfavourable.*

Thomas C., æt. 11. Admitted January 27, 1879.

Right eye lost from "purulent ophthalmia" some years ago. Six months ago it was injured by his running against a play-mate.

Left eye. For the last fortnight this eye has been affected. It then became red; has ached occasionally, and has had lachrymation and photophobia.

Right. Globe injected. The cornea is shrunken, with superficial leucoma and vascularity. No perception of light.

Left. Ciliary injection; pupil fairly well dilated under atropine. The iris seems to be on two different levels, the periphery being very near the cornea, while the central part is deep, and bound down to a large extent to the lens capsule. Small spots of uvea left on anterior capsule where adhesions have given way. T.n. No details of fundus visible. V. = counting fingers at 2 feet.

Right excised. Atropine and black bandage to left.

Feb. 10. Ordered mercurial inunction. 12. V. = hand-reflex only. Less ciliary injection. March 13. Counts fingers at 8 inches. April 20. Much *in statu quo*. Counts fingers at 14 inches. May 2. Pupil excluded and occluded. Iris vascular. A. c. shallow. —T. 1. Counts fingers at 20 inches. Discharged.

This patient could not be traced again, so that his subsequent history is unknown.

Pathological Examination.—Measurements of globe are: antero-posterior, 23·5 mm.; lateral, 23·5 mm.; vertical, 22·5 mm. Its tension is normal. The cornea is very small, and moderately densely leucomatous all over. It is rather flattened, and presents numerous superficial blood-vessels. On *equatorial section* a thin yellow fluid escapes. The retina is soft, and detached from the choroid into an umbrella shape. Its cavity, small but not tightly contracted, contains the scanty rather tough remains of the vitreous. The choroid is pale brownish-yellow in colour. The yellow spot is in the centre of a darker area. The choroid at the periphery is also rather darker, and is studded with small fine white, or nearly colourless dot-like deposits (apparently colloïd nodules in an early stage). The iris is thick and closely adherent to the cornea, except just at a small central area. Its pigment layer is irregularly thickened. The connective tissue layer which lines the ciliary muscle internally is also inflamed and thickened, but the muscular fibres themselves are pretty healthy.

CASE XL.—*Repeated Needle Operations for Opaque Membrane after Cataract Extraction. Sympathetic Ophthalmitis about six months after the last needling. Iridectomy, and subsequently Excision of Sympathising Eye. Retention of excellent Vision by Exciting Eye.*

Ann H., æt. 54. Admitted March 20, 1879.

Left eye. Cataract extraction here last August by Mr. Streatfeild's method. The tension of both had previously been noted as rather full, and the operation had to be postponed for a day or two on account of spontaneous conjunctival ecchymosis. The lens came away well, and the eye remained quiet. In November there was opaque membrane in the pupil, which was needled on the 4th. That night there was pain. On the 9th the outer half of the pupil was still covered, and needling was done again. On the 13th there was slight injection and a little tenderness to touch; pupil still partially covered, Jan. 29, 1879. *Left eye.* Opaque membrane in pupil. *Right eye.* Cataract immature, $V. = \frac{4}{200}$. Peculiar glistening appearance of eye-

ball, but it does not water much. Slight ciliary injection. 30. *Left.* Needled (1 needle). Ordered ice and atropine. Feb. 3. *Left.* Much injected. Slight pain. + T. 1? Empl. Lyttæ. on left mastoid. 5. Eye stronger; complains of muscæ. 21. *Left* too weak still for testing. *Right* stronger than before. Discharged. *Present condition:* *Left eye* looks quiet. No injection remarked. *Right eye.* Conjunctiva injected and slightly cedematous. Keratitis punctata. Numerous dots all over posterior surface of lower half of cornea. Anterior chamber deep. + T. 1. V. much worse than when last tested. Ordered atropine drops and black bandage. 31. *Right eye.* Last evening she had heavy pain above outer part of this eyeball, relieved by a gush of tears. Still much ciliary injection. + T. 2. April 3. Severe throbbing pain for last two days or so in both temples, generally alternating. This pain makes her feel sick. R. E. + T. 2; L. E. + T. 1. 6. R. E. + T. 2. Vision slightly improved. L. E. T.n. Feels stronger. 14. R. E. + T. 1? Cornea brighter, and eye generally quieter. Discharged April 14.

Re-admitted April 24, 1879. *Left eye* quiet. Pupil slightly

drawn up. Adhesion of iris to scar. *Right*. Conjunctiva slightly chemosed. Cornea hazy. Posterior synechiæ. V. = hand-reflex. + T. 2. Iridectomy upwards to-day. 26. Blood in a. c. since operation; a. c. reformed, but very shallow. 30. Pain varies from day to day; less injection. May 2. Occasional throbbing in outer part of eyeball; much lacrymation. T.n. Capsule of lens covered by lymph. 12. Glands of right side of face and neck swollen. Much pain in this cheek. Less lacrymation. 17. Yellow purolymph in pupil for last few days. Still much photophobia. 26. Small irregular opacity at posterior part of cornea near centre. June 11. *Right* eye quieter. Discharged. Re-admitted July 10, 1879. About a week ago the right eye became inflamed and very painful. There is now much swelling of lids and œdema of conjunctiva. Bulging of ciliary region above. Central onyx of cornea. + T. 1. V. = hand-reflex. Corneal section made through onyx. Ordered poppy fomentation. 13. Cornea clearing. 24. She has had several severe attacks of pain lately, and wishes to have the right eye removed. R.E. excised. 31. L. c + 3". V. = $\frac{20}{40}$ partly, c + 2'', reads Jaeger 1 at 6''. Eye still weak. Discharged. August, 1886. She writes to say that the eye continued well until last November, when it became red. This redness continued more or less till March (1886), when pain and dimness came on, and she then attended Moorfields as an out-patient once. With rest and treatment the attack soon passed off, but the sight is not quite so good as before. Dec., 1886. Writes that she believes her sight is not worse than it was in August.

Pathological Examination.—The globe is hard (T. + 1), and not much below the normal size, all diameters measuring about 24 mm. The cornea is opaque: a transverse scar (about half its breadth) extends across its centre; just above its upper margin the ciliary region is pale and slightly prominent as if from some degree of staphylomatous bulging. An *equatorial section* shows the vitreous to be clear, but rather firm, and apparently rather more stringy in its texture than usual. The retina and choroid are *in situ*. The optic disc is rather swollen; its blood-vessels are small and appear streaked with white along their sides. The yellow spot is a dark point surrounded by a rather less dark area, outside this the fundus is

lighter coloured, to become again of a darker brown as we near the ora serrata. There is a haze on the ciliary processes, which is more marked towards their posterior border. The lens is quite opaque and rather spermaceti-like in appearance; it is softish and comes away readily. The upper iris limb is wanting; the lower adheres to the cornea both at its centre and at its periphery. Microscopical sections show extreme inflammation of the episcleral tissue. The iris is much thickened by inflammatory cells, and has an exudation layer behind its uveal pigment. There is a conical plug of inflammatory cells in the centre of the optic papilla, with great multiplication of cells in the sheaths, and apparently also in the walls themselves of the blood-vessels of the papilla.

CASE XLI.—*Sympathetic Inflammation occurring seven weeks after a Perforating Ciliary Wound of the other Eye. Excision of the Exciting Eye. Gradual Deterioration of Vision from persistence of Inflammation and Increased Tension. Temporary benefit from Sclerotomy.*

Edward J. T., æt. 31. Admitted August 12, 1879.

Right eye. Injured in May last by the bursting of a soda-water bottle. The sight of the *left* began to get dim seven weeks afterwards. *Right*: puckered cicatrix in ciliary region; globe shrunken. No perception of light.

Left. Slight ciliary blush. Minute dots arranged in a wedge shape on posterior aspect of cornea below. Pupil very sluggish, almost quite inactive to light. T.n., but rather low.

Right excised on admission. Ordered atropine drops for left.

26. Pupil dilated irregularly, but fairly well: it is a horizontal oval. T.n.

$$29. V. = \frac{20}{70} \text{ c} - 12'' \text{ sph.} = \frac{20}{40}.$$

Sept. 2. There is now slight conjunctivitis in left. Atropine discontinued. Astringent ordered.

18. Eye quiet. Very slight injection. Thin layer of lymph in pupil preventing accurate view of fundus. $V. = \frac{20}{40}$. Jaeger 1 at 10''. Discharged Sept. 23.

Re-admitted Oct. 17, 1879. Pupil nearly or quite excluded. V. very bad; can just see fingers, but not so as to count them correctly. T.n., or — T. 1? Ordered atropine drops and to wear black bandage.

25. Eye much quieter and less injected. Pupil dilating slightly.

29. V. = $\frac{20}{50}$. Slight injection. Iris somewhat *bombé*. T. 1?

Discharged.

Re-admitted Dec. 22, 1879. The eye soon became painful after returning home, but this was relieved by leeching and blistering. Soon afterwards he had another attack, from which he is still suffering. The cornea is hazy. Pupil excluded and occluded. Iris atrophied and bulging locally down and out. Reads Jaeger 16. + T. 1? Ordered atropine drops. 27. Slight pain. T. + 1. 28. Much burning pain in forehead and eyeball. Lacrymation and great ciliary injection. Photophobia. T. + 2. Atropine discontinued; two leeches to left temple. 29. Pain was relieved by leeching. Has "neuralgia" in left temple and forehead. Hot water fomentations. Jan. 3, 1880. Eye much easier and sight better to-day. T.n. low. The bulging of iris below is now much smaller, and the globe is less injected. 4. Return of pain. T. + 1. Ordered eserine drops. 5. Severe pain early this morning, only slightly relieved by leeching, but much relieved by subcutaneous injection of morphia. 13. He has had several attacks of pain lately. T. + 1. Stop eserine. Feb. 3. T. + 2. Thinning of ciliary region above. Just counts fingers. 13. Sclerotomy upwards, of small size, but in good position. 14. Anterior chamber re-formed but shallow. — T. No bulging of iris now below. 19. Iris again bulging. Vision improved since sclerotomy. Reads Jaeger 16. 27. Iris brighter but still bulging. Eye much quieter. T.n. full. March 3. Keeps quiet. T. + 1. Discharged.

The further progress of this case could not be ascertained.

Pathological Examination.—The eye is shrunken. There is a puckered cicatrix at one side of the cornea extending into the ciliary body. The lips of the wound are much pulled in. On *antero-posterior section* the iris is seen to be firmly united to the edges of the wound. It has a thick white tough layer on its posterior surface. The retina is detached into an umbrella

shape. It is puckered up into deep longitudinal folds, and is firmly adherent to the fibrous plug which separates the lips of the wound and forms the scar tissue. No vitreous remains are visible in its small cavity. The choroid is *in situ*. Near the periphery its colour is darker brown than elsewhere, and rather irregularly intermixed with rather paler areas. *Microscopically* the iris is vastly thickened. It contains in its stroma numerous aggregations of inflammatory cells and a layer of connective tissue behind its thickened, much scattered, uveal pigment. The adventitia of its arteries is clear looking and very thick. The muscular structure of the ciliary body is pretty normal, but the connective tissue layer is thickened with inflammatory cells distributed as in the iris. The choroid is similarly thickened, but the groups of cells are found more particularly in its outer layers. The vitreous lamina bounding its internal surface is wrinkled. Colloid nodules appear to be present on it. The long ciliary nerves are normal, but some inflammatory cells surround the long ciliary arteries in their course through the sclerotic. The optic nerve presents some slight increase of nuclei near the disc, but its fibrous stroma is not hypertrophied.

CASE XLII.—*Severe Iritis, presumably Sympathetic in Nature, occurring six years after loss of other Eye from Perforating Wound. Ultimate result unknown.*

Edmund R., æt. 72. Admitted March 21, 1877.

Left. Lost shrunken globe, result of perforating wound six years ago. *Right* has given no trouble until a week ago, when it became inflamed. Cornea nebulous above. Pupil small and drawn up; posterior synechiæ. Iris tissue infiltrated with lymph. Hyphæma. Bare perception of light.

Ordered atropine drops and belladonna fomentation. 24. Pupil not dilated. There is still blood in the anterior chamber. Very little pain. April 4, discharged.

Examined May, 1884. *Left*, much squared. No pain. *Right*, an iridectomy upwards has been done elsewhere. The pupil is drawn up to the scar. Bare perception of light. Tn. but rather low.

CASE XLIII.—*Perforating Wound of Eyeball followed two months later by severe Sympathetic Inflammation leading to practically Complete Blindness.*

Sarah J. P., æt. 10. Admitted August 29, 1879.

The *right* eye was injured two years ago by a perforating wound with a pair of scissors. It is now shrunken, soft, and absolutely sightless. Dimness of sight began in the *left* eye two months after the above injury, and has got progressively worse since; the eye has been red and painful. There is now a large central nebula of cornea, seemingly the result of a past keratitis punctata; anterior chamber very shallow; pupil occluded and total posterior synechia; T. — V. = hand-reflex barely. Discharged August 30.

In the following four cases the inflammation is very doubtfully sympathetic, but they were believed to be probably of this nature on admission.

CASE XLIV.—*Shrunken Globe with Bony Degeneration following an old injury. Sympathetic Symptoms first observed about thirty years after the original Wound. Result favourable.*

James O., æt. 48. Admitted August 7, 1877.

Right eye lost from a wound with a stone 32 years ago. There is a puckered scar across the cornea. Globe much shrunken and squared. The *left* eye began to be dim-sighted about a year and a half ago. It has only once been painful, and that only for an hour or two, about two months ago. There is now recent marginal ulceration of the cornea at the outer and inner sides. Pupil small, irregular, and blocked: the outer side still acts slightly to light. Counts fingers at about 3 feet. 11. *Right* eye excised. 18. *Left*. Iridectomy upwards. 20. Anterior chamber nearly half full of blood. Sept. 5. Good coloboma. Lens cataractous. A little bright blood in bottom of anterior chamber. Counts fingers. Discharged.

Re-admitted, Nov. 2, 1877. Eye quiet. Has had pain in the eye lately but none now. Counts fingers at $2\frac{1}{2}$ feet. Discharged Nov. 3.

Re-admitted May 21, 1878. Much *in statu quo*. T. full. Vision much as before. Advised to return when sight is no longer of any use. Discharged May 25.

Pathological Examination.—Bony degeneration of choroid.

CASE XLV.—*Old Corneal Ulceration in one Eye. Iridectomy twice for Leucoma and Secondary Glaucoma. Severe Pain following a Blow upon it some years later, and Iritis in other Eye. Excision of exciting Eye. Ultimate result excellent.*

John M., æt. 22. Admitted April 25, 1877.

Left eye injured about four years ago and removed on account of pain. The old notes are shortly as follows:—"Feb. 9, 1869. *Left* has been weak ever since measles in childhood. Iridectomy done three weeks ago. There is now a staphyloma of fourteen days' duration. Globe tense. Iridectomy done again. Feb. 11. Section united. Pupil clear." On Oct. 4, 1873: "*Left* large artificial coloboma up and in. Considerable patchy opacity of cornea. Lens clear. Large floating opacities in vitreous. Iris partially adherent to capsule of lens; remains of old iritic adhesions in coloboma. Fundus not visible. Has perception of large objects and projects correctly. The whole ciliary region appears thinned and of a bluish colour. No distinct staphylomatous bulging. Only slight pain at times until two months ago, when this eye was injured by a blow with a broom handle. Excised. Oct. 7. Discharged."

The *right* eye was inflamed (? corneal ulceration) a year before the injury to the *left*. Shortly afterwards it again became painful and inflamed. Present condition is as follows:—T. 1. Iris thick and vascular; posterior synechiæ. Small marginal opacities on cornea and faint central nebula (no note of vision). Ordered belladonna fomentation, atropine drops, and blistering to temple. May 12. The pupil has dilated decidedly. V. has improved, now = $\frac{20}{70}$. Discharged.

Examined on Feb. 27, 1878. *Right*. No vascularity of iris. Eye feels easier. Posterior synechiæ except outwards. T.n. but low. Well marked ciliary atrophy. There is more or less mistiness as the light fails in the evening. V. = $\frac{20}{30}$ partly, with — 40" sph. = $\frac{20}{20}$ fairly. There is slight cupping of the optic disc well up to the margin, but no undermining.

CASE XLVI.—*Left Globe Shrunk.* Iritis in other Eye several years after loss of Vision in Right. Duboisine delirium. Result good.

Robert H. S., æt. 51. Admitted May 12, 1879.

The *left* eye was never of much use; the sight left it entirely in 1871, and the globe then began to shrink. It has never been painful.

The *right* eye had "glaucoma" in April, 1871, but no iridectomy was done, as the eye meanwhile recovered spontaneously. His V. then was $= \frac{20}{30}$ without correction (from out-patient notes). The eye has continued well ever since till eight days ago, when it became bloodshot and painful, with dimness of sight.

He is a healthy-looking man; dark hair and complexion. He is subject to articular rheumatism, but there is no family history of joint or eye affection.

Left eye. Shrunk squared stump. *Right* eye. Conjunctival and ciliary injection. Arcus senilis above. Pupil rather sluggish; dilates eccentrically but evenly under daturine, exposing spots of uvea on the anterior lens capsule; vitreous clear. O.D. slightly excavated with small crescent at outer side.

V. $= \frac{20}{200} \text{ c} - 30'' = \frac{20}{40}$ and $\frac{20}{30}$ partly. Colour perception good.

T.n.

13. *Left* excised. Ordered atropine to right, and dark bandage. 18. Last evening he raised his bandage for a moment to see and found his sight very good. Since then he has had severe pain across the forehead and round the head. The sight is more dim. + T. 1? Sees coruscations, &c.; to use duboisine instead of atropine drops. 19. T.n. Sight quite clear again. Pain all gone except a little in occipital region. 23. Since using duboisine he has had optical illusions, "strange looking animals sitting on the top of chairs piled one on another."

June 2. R.V. $= \frac{20}{30}$ fairly, c $- 80'' - \frac{20}{20}$ fairly. There is a circle of uvea-dots on anterior capsule corresponding to old pupil. T.n. Discharged.

XLVII.—*One Eye injured by Chip of Steel; Affection of second Eye some months later. Restoration of useful Vision in second Eye after Extraction of the Lens. The injured Globe ultimately lost and excised.*

John S., æt. 38. Admitted September 25, 1879.

Left eye. Injured by piece of steel about 20 years ago. The sight has never been so good since as it was before this accident; "the pupil was drawn in a sort of oblong." Some months later the sight of the *right* became affected, and this eye was operated on elsewhere 17 years ago, the lens being removed. No history of syphilis, rheumatism, or gout.

R.E. Small black pupil; lens absent. T.n. V. c + 10 D. = $\frac{20}{200}$, and c - 11 D. reads J. 10 at 12".

L.E. Pupil eccentric, closed and occluded. Iris *bombé*. V. = hand-reflex well. T.n.

26. L.E. Iridectomy attempted up and in; iris very rotten, and none could be obtained. October 7. L.E. Conjunctival injection. — T. 1? Excised.

Pathological Examination.—The globe of normal size, its measurements being,—antero-posterior, 25 mm.; lateral, 25 mm.; vertical, 24.5 mm. Its tension is normal. The cornea is clear, the anterior chamber extremely shallow at best, but obliterated entirely over two areas—one to the upper and outer, and the other to the lower and outer side. The iris is adherent to the cornea at the margins of each of these areas by several felty looking points. Indeed, this felty appearance of the iris is general, that is to say, its structural details cannot be recognised. The colour is grey mottled irregularly with much darker spots. A minute dark central spot marks the position of the closed pupil. Near the lower and inner margin of the cornea are two little apertures, as if the iris fibres were torn apart here. *Equatorial Section.*—The clear and slightly solidified vitreous is seen to be somewhat shrunken towards its anterior attachments. Between it and the retina, which is *in situ*, is rather thin fluid. The optic disc is distinctly swollen and slightly hazy. The lens is *in situ*; its nucleus is brown and cataractous; its anterior capsule presents several whitish-grey patchy areas, apparently the results of posterior synechiæ. The ciliary processes are very slightly

greyish from a fluffy deposit on their internal surface; otherwise they look normal.

GENERAL SUMMARY.*

I. Age.

The age of the patient at the onset of the sympathetic disease is here meant.

The youngest was aged 4 years, the oldest 79 years.

TABLE I.

Giving the Number of Cases met with occurring in each Decade of Life, and the percentage in each Decade of the total number resulting from Injury.

	From perforating injury.	From operation.	From other causes.	Total.
Under 10 years.....	5 or 20 p. c.	1	..	6
10 to 15 " = 3	} 4 " 16 "	1	1	6
15 " 20 " = 3				
20 " 30 "	4 " 16 "	..	1	5
30 " 40 "	3 " 12 "	..	2	5
40 " 50 "	5 " 20 "	..	..	5
50 " 60 "	2 " 8 "	4	1	7
60 " 70 "	2 " 8 "	4	..	6
70 " 80 "	1 " 4 "	2	..	3

There is here a remarkable similarity in the number of cases occurring in the different decades, and, although from such comparatively small numbers we must draw statistical conclusions with much caution, we may infer that those advanced in life are at least as liable to this affection as the young. Indeed, if we consider the total number of persons living at different ages,† the numbers given in this table would favour the view of greater relative liability in advanced life. This is a question of

* In the following examination of the above recorded cases, those that were considered doubtful in their sympathetic nature (Nos. 44—47) will not be included except when specially mentioned.

† See Farr's Vital Statistics, 1885, pp. 467—8, where Decennial Tables are given for the London districts of Hanover Square and Whitechapel.

some importance, in as far as it has been repeatedly asserted that children are more subject to sympathetic ophthalmitis than adults.

With the view of investigating this matter of liability according to age, I have collected all the cases of accidental perforating injury admitted as in-patients at Moorfields during the same period (a little over three years) in which the sympathetic cases came under treatment. By "recent" cases (see below) I mean only such as were admitted within a fortnight after the injury; they were consequently serious enough for admission from the mere severity of the injury, and not, except perhaps very exceptionally, from any complication. From these statistics we may form an idea of the relative number of cases of severe perforating injury *liable to be met with* at different ages.

TABLE II.

Showing all Cases of Perforating Injury met with, arranged according to the different Decades of Life in which they occurred, and giving the relative percentage in each Decade.

	Recent perforating injuries.		Total perforating injuries.	
Under 10 years	41 or about 20 p. c.		88 or about 23 p. c.	
{ 10 to 15 "	46 {	22 " 10½ "	85 {	46 " 12 "
{ 15 " 20 "		24 " 11½ "		39 " 10 "
20 " 30 "		47 " 23 "		80 " 20½ "
30 " 40 "		39 " 19 "		62 " 16 "
40 " 50 "		16 " 7½ "		36 " 9 "
50 " 60 "	12 " 6 "		23 " 6 "	
60 " 70 "	3 " 1½ "		8 " 2½ "	
70 " 80 "	2 " 1 "		3 " 0¾ "	

It will be seen—and this holds good even after correction for the much diminished number of persons living at more advanced ages—that accidents of this nature are most apt to occur before forty years of age. This extra liability is fully accounted for by exceptional exposure during a great part of this period; in childhood the care-

lessness or awkwardness of companions ranks as a fruitful source of such accidents.

If we now compare with Table II the figures in the first column of Table I, where the numbers of cases of sympathetic inflammation at different ages due to perforating injury are given, we get (so far as these statistics can give it) some knowledge of the proportionate liability to the occurrence of sympathetic disease after such injury in the different decades of life.

TABLE III.*

Giving the Proportionate Relation of Sympathetic Inflammation from Injury to the number of Cases of Injury met with at different Ages.

	To recent cases.	To total number of perforating injuries.
Under 10 years...	About $12\frac{1}{2}$ p. c.	About $5\frac{3}{4}$ p. c.
{ 10 to 15 " ...	" 9 "	" $4\frac{1}{2}$ "
{ 15 " 20 " ...	" $8\frac{1}{2}$ "	" 5 "
20 " 30 " ...	" $8\frac{1}{2}$ "	" 5 "
30 " 40 " ...	" $7\frac{3}{4}$ "	" $4\frac{3}{4}$ "
40 " 50 " ...	" 31 "	" 14 "
50 " 60 " ...	" $16\frac{1}{2}$ "	" $8\frac{3}{4}$ "
60 " 70 " ...	" 66 "	" 25 "
70 " 80 " ...	" 50 "	" 33 "

The relatively high percentage of sympathetic inflammation after accidental injury in advanced life met with at Moorfields during this period is doubtless due, in great measure at least, to an exceptional series of cases. We must also bear in mind that older people are more inclined to stay at home after an accident than younger, and generally only come to hospitals if compelled to do so by the onset of severe pain or other complication. This latter fact must falsify all hospital statistics of this or

* In all these tables I have subdivided the decade 10 to 20 to see whether there was any marked difference in liability in the five years before and after the average age of puberty. It will be seen that no such difference is shown.

kindred nature.* Making every allowance, however, for such causes of fallacy, the impression left with us is that there is no just foundation for the common opinion that the young are especially subject to get sympathetic disease from injury.

How far age was found to determine the severity of the inflammation and the rapidity of its occurrence will be considered later.

II. *Nature of the Primary Affection of the Exciting Eye.*

A. *Accidental Wounds.*—In six cases the cornea was the only external coat penetrated, but the iris appears always to have been involved, either being actually wounded or by becoming prolapsed. In six cases the ciliary region was wounded, and in three others it was ruptured by a blow with a blunt instrument. In one the sclerotic alone was wounded. In eleven the site of the wound is not mentioned; but, from the nature of the accident, the anterior part of the eye was penetrated in every instance.

Very various instruments were the causes of these injuries. In four cases the eye was ruptured by a blunt body (cow's horn, fist, boot, candlestick); in three the eye was penetrated by a piece of metal flying off while at work, and in one of these it remained in the globe; in two it was cut by children's toys (tip-cat and flying top); in two by the bursting of aerated water bottles; in one by gun-shot; in three by sharp pieces of wood. Among the other instruments we find a table-fork, knife, pair of scissors, steel umbrella rib, door latch, corn rake, &c. In one case the injury was said to have been inflicted by a large hailstone.

B. *Operations.*—In six cases the operation performed was cataract extraction; in three of these the incision was the original linear one recommended by von Graefe,

* This source of fallacy is pointed out by Priestley Smith "On Primary Glaucoma in Relation to Age," Trans. Ophth. Soc., vol. vi, p. 305.

in the remainder a modified linear incision. In two other cases the sympathetic inflammation seemed due to needling opaque membrane after removal of cataract, rather than to the extraction itself. In all these cases either the iris was adherent to the cicatrix, or severe inflammation implicating the iris occurred during the after-treatment; in two of these there was panophthalmitis, and in another much shrinking of the exciting eye before the outbreak of sympathetic inflammation. Of the remaining operation cases, one was iridectomy for increased tension in a case of corneal ulcer; one iridodesis for artificial pupil in lamellar cataract; one Saemisch section for corneal abscess (followed by prolapse of iris); and one trephining a dense corneal leucoma in a partially shrunken eye.

C. *Other Causes*.—In four cases the exciting eye was damaged by old corneal ulceration; in the only other case the eye was lost from inflammation “following a poisoned wound by fly-bite.”

III. *Interval*.*

A. *Short*.—All cases occurring within the first month may be included here.

The shortest interval observed was one of about 14 days (Case 8), and there is considerable doubt as to the exact period here. It was a case of cataract extraction, followed by needling, in which at the time of the secondary operation, nothing was observed amiss with the other eye.

In three cases there was an interval of 3 weeks, and in one case of 24 days. It may be remarked here that in four of these five cases, with short interval, the result as regards the sympathiser was exceedingly bad.

* By *interval* is here meant the time elapsing between the primary affection of the exciter and the onset of sympathetic inflammation. The division into short, moderate, and long intervals is the same as that adopted by the Committee on Sympathetic Ophthalmitis. See their Report in Trans. Ophth. Soc., vol. vi, p. 170.

In Cases 24 and 26 sympathetic inflammation commenced a few days after a second injury, but in both the primary injury would seem to have been the real cause of the disease.

B. *Moderate*.—In this category I have placed all cases in which the interval was at least one month and not more than one year.

Interval =	1	month	in 1 case.	
„ =	5	weeks	„ 1 „	
„ =	6	„	„ 2 cases.	
„ =	7	„	„ 2 „	
„ =	2	months	„ 4 „	
„ =	2½	„	„ 5 „	
„ =	3	„	„ 6 „	
„ =	4	„	„ 4 „	
„ =	5½	„	„ 1 case.	Blow on eye lost from old inflammation.
„ =	8	„	„ 1 „	In this case the interval was doubtful; possibly shorter than here stated.
„ =	10	„	„ 1 „	

The liability to sympathetic inflammation would thus appear to be at its maximum between the 2nd and 4th months after the primary affection of the exciting eye.

C. *Long* (or more than one year).—In Cases 2, 20, 23, 29, 33, 37, 38, 42 the exciting eye was damaged by injury. In one of these (33) the interval was exceedingly long, viz., 30 years or more, but the exciting eye had been occasionally painful for 18 months before the onset of sympathetic symptoms. The choroid of the excised eye had undergone bony degeneration, and a layer of pus (?) is said to have been found on its inner surface. Although no inflammation was noted at this date, it is possible that a careful examination might have shown minute dots on Descemet's membrane, or traces of iritis. The latter seems never to have been acute, as there was no history of attacks of severe pain. No history of rheumatism or gout could be obtained when in hospital, but during the past year (1886) he has had pain in his insteps and legs.

The next longest interval was one of 20 years (Case 37), and there was no recent pain or redness in the shrunken

exciting eye: there is little doubt as to the true sympathetic nature of the inflammation here. In Case 23, 11 years elapsed between the injury and inflammation of the second eye; but here there is a history of the sympathiser having been irritated by a small foreign body just before the outburst. In two cases (38, 42) there was an interval of six years, and in neither is there any note of the exciting eye having been recently affected. In Case 29 there was an interval of two years. In the remaining two cases (2, 20) the interval was $2\frac{1}{2}$ and two years respectively: in the former the exciter had been inflamed and painful for some months before the second eye suffered.

In two cases of very long interval the exciter was lost from corneal ulceration. In one of these (Case 4) the interval was 39 years, and the exciter does not appear to have been recently inflamed. In the other (Case 15) the exciter had been painful shortly before the sympathetic symptoms commenced, the interval reckoning from the corneal ulcer being 23 years. Both cases were alike in there being keratitis punctata, with little or no pain in the sympathising eye.

Relation of Interval to Age at Date of Sympathetic Disease.

The following table deals with much too small a number of cases to be in itself even suggestive, but it may be of service to anyone dealing with similar statistics on a large scale. We are manifestly, other things being equal, more liable to get cases with a long interval as age increases, and we might perhaps expect the shortest intervals in childhood when tissue-changes in general are most active. The table would rather support the latter expectation, and we find that the longest intervals occurred at a time of life when increased liability from age had not been counteracted by the decrease in the actual number of persons living. Again, in the aged the nature of the primary lesion in the exciter may mainly determine the interval, the great majority being from cataract extraction.

TABLE IV.

Giving Length of Interval in different Decades of Life.

	Short.	Moderate.	Long.
Under 10 years	2	4	
10 to 20 "	..	6	
20 " 30 "	1	..	4
30 " 40 "	1	3	1
40 " 50 "	..	2	3
50 " 60 "	..	7	
60 " 70 "	1	4	1
70 " 80 "	..	2	1

Relation of Interval to the Nature of the Primary Affection of the Exciter.

TABLE V.

	Short.	Moderate.	Long.
Accidental wounds	4	14	8
Operations	1	11	..
Corneal ulceration	..	2	2

Of cases where the exciter had been lost or impaired by corneal ulceration, the sympathising eye was affected very late in two. It may be objected in such cases that the inflammation in the second eye was not proved to be truly sympathetic in nature, but in those given here it was very similar in character at least to the sympathetic form.

In regard to operations, the only case in which the interval was short was the somewhat doubtful one already referred to, where sympathetic inflammation came on a fortnight after needling, and $2\frac{1}{2}$ months after cataract extraction. In none of the operation cases was the interval long. So many of these operations were done for extraction of senile cataract, that age is presumably a factor in determining the length of interval. The interval in the

case of injuries varied exceedingly, and was probably influenced, here as elsewhere, not only by the age of the patient, the character of the injury (*e.g.*, its exact site, nature, and condition of instrument), but also by the treatment adopted subsequently (as regards avoidance of exposure to bright light or cold), by the patient's state of health, his natural predisposition to iritis, &c.

IV. *Character of the Sympathetic Inflammation.*

All the cases are here arranged in three groups, according as to whether the inflammation was *mild*, *moderate*, or *severe*.

A. In five instances (Cases 4, 6, 11, 22, 24) the attack may be said to have been distinctly *mild*. In all of them the disease ran a short course without any very urgent subjective symptoms, and there was no relapse. Locally there was slight ciliary injection: posterior synechiæ were formed in all, but the pupil dilated well under atropine, except in Case 6, where one synechia persisted. (This latter case, indeed, was altogether more severe in type than the other four included here, though considerably milder than those in the next group.) Keratitis punctata was noted in only two of them, but possibly occurred more frequently, as the cornea was not then so carefully examined as is now the custom. It may be noted that in *all* of them the exciting eye was excised soon *after* the outbreak of the disease in the sympathiser.

B. In more than one-half the total number of cases the inflammation was *moderate* in intensity. The general characters of the affection in such cases are these:—The attack is somewhat prolonged, with a marked tendency to relapses, or at least remissions. The sympathising eye is not rapidly rendered sightless, but tends to deteriorate with each fresh exacerbation of the disease. The pain is rarely very acute, and is then generally relieved by leeching or other simple treatment. The local symptoms vary considerably in different cases, especially as to the

amount of ciliary injection and tenderness and of iritic infiltration. Keratitis punctata is usually well marked, if indeed not universal in cases of this type.

As will be seen subsequently, in at least half the 24 cases coming into the group, the inflammation, although moderate in intensity, ultimately led to loss of the eye.

C. In 14 cases (1, 2, 3, 5, 7, 16, 18, 23, 28, 30, 32, 34, 40, 42) the inflammation was acute and very *severe*, accompanied frequently by great intractable pain, and leading rapidly to loss of sight in the sympathising eye. In the most severe cases of all I do not think that keratitis punctata is by any means constant.

The relationship between the character of the inflammation and age, interval, &c., will be considered under the next heading, viz. :—

V. *Final Condition of Sympathising Eye.**

The final condition is here spoken of as *good* when the eye retained at least two-thirds of normal vision; *moderate* when it was still an useful organ in guidance, and could decipher at least the larger of Jaeger's test-types; *bad* when it could at most only distinguish light from darkness.

A. *Good*.—The five cases under this heading we have already cited as examples of a *mild* type of inflammation; there can, I think, be no doubt as to their true sympathetic nature. In only one of them was the ultimate vision less than $\frac{20}{20}$ partly, the exception being the case previously referred to as having a persistent posterior synechia.

B. *Moderate*.—There are twelve instances of this final condition, viz., Cases 10, 13, 17, 20, 21, 25, 26, 27, 31, 33,

* In order to ascertain the ultimate result, the patients have, when possible, been kept under observation. Unfortunately, however, several of them ceased to attend, and could not be afterwards traced; others left their old homes, and were obliged to become inmates of workhouses, and could not always come to hospital when sent for.

37, 41. In five of these the patients were only a short time under observation.

C. *Bad*.—In no fewer than 25 cases the sympathising eye is known to have been rendered useless by the inflammation, and in another case (42) the result was doubtless similar, though it was not ascertained with certainty. All light-perception was lost in this eye in nine instances (Cases 1, 7, 8, 15, 18, 19, 30, 34, 40), and the globe was excised in six of these.

From the after-history obtained in some cases it is probable that the ultimate result was bad in several of those here classed as *moderate*, but which were lost sight of. In 12 of the 24 cases in which the inflammation was moderate in severity, the final result was bad. A progressive deterioration is noticeable particularly in Cases 9, 15, 19, 34, 36, and 38. Our prognosis must therefore be a guarded one in all cases of moderate severity. Sometimes the deterioration has been largely or entirely due to changes in the lens subsequent to the sympathetic attack; in such cases the vision may frequently be improved by operation if the tension of the globe has remained good.

Relation of Character of Inflammation and Final Condition to Age at Date of Sympathetic Disease.

TABLE VI.

Giving the Character of the Inflammation and the Result in the Sympathising Eye in different Decades of Life.

Age.	A. Mild or Good.		B. Moderate.		C. Severe or Bad.	
	Inflamma- tion.	Result.	Inflamma- tion.	Result.	Inflamma- tion.	Result.
Under 10	..	..	6	3	..	3
10 to 20	..	..	5	2	1	4
20 „ 30.....	..	..	2	..	3	5
30 „ 40.....	2	2	1	1	2	2
40 „ 50.....	1	1	4	4	..	..
50 „ 60.....	2	2	2	1	3	4
60 „ 70.....	..	..	4	1	2	5
70 „ 80.....	..	..	..	..	3	3

The tendency to a severe type of inflammation and an unfavourable result would thus appear to be greater at the extremes of life, but the statistics as regards the aged are modified by the nature of the primary affection of the exciting eye (see following table). The fallacy previously noticed, viz., the tendency of old people to avoid coming to hospital if possible, does not apply so forcibly here, as all cases of cataract extraction had to return for glasses, or for subsequent operation.

Relation of Character of Inflammation and Final Condition in Sympathising Eye to Nature of Primary Affection of Exciter.

TABLE VII.

	A. Mild or Good.		B. Moderate.		C. Severe or Bad.	
	Inflamma- tion.	Result.	Inflamma- tion.	Result.	Inflamma- tion.	Result.
Accidental wounds	3	3	18	9	5	14
Operations ...	1	1	3	2	8	9
Corneal ulceration, &c.	1	1	3	1	1	3

The type of inflammation was thus relatively very severe after operations. Eight of these followed extraction of senile cataract (two of them after a subsequent needling), and in seven of these the result was bad. How far this high percentage of severity was due to the nature of the operation, and how far to a presumably unfavourable predisposition from age, it is impossible to determine from these cases.

As regards the accidental wounds, mere position of injury did not seem to influence the character of the inflammation or the result; wounds of the ciliary region had as low a percentage of severity as those confined to

the cornea with implication of iris. Similarly, the nature of the instrument appeared to make no difference in this respect.

Relation of Character of Inflammation and Final Condition to Interval.

TABLE VIII.

Interval.	A. Mild or Good.		B. Moderate.		C. Severe or Bad.	
	Inflamma- tion.	Result.	Inflamma- tion.	Result.	Inflamma- tion.	Result.
Short.....	..	..	3	1	2	4
Moderate	4	4	15	8	11	18
Long.....	1	1	6	3	1	4

The interval appears to have little or no relation with the severity of the disease in these cases; perhaps the tendency to a bad result may be said to have been rather greater with a short than with a moderate or long one.

V. Final Condition of Exciting Eye.

In 34 cases the exciting eye was lost, and in 30 of these it was excised, either on account of pain in itself or sympathetic affection in its fellow. Where the exciter, although lost, was quiet, and the other eye not in a position likely to be benefited by the operation, it was not excised. In three cases (22, 24, 34) the exciter, although not really lost, was excised; in two of these its fellow was already inflamed before the excision, yet ultimately recovered excellent vision; in the remaining case the exciter was removed for sympathetic *irritation*, but subsequently violent ophthalmitis set in and caused the loss of the sympathiser.

In six cases (8, 9, 10, 18, 30, 40) the exciting eye retained useful vision, although the sympathiser was lost

in five of them and greatly damaged in the sixth. In four of these the primary lesion in the exciter was cataract extraction (Cases 8, 18, 30, 40), and it is remarkable to note how quiet this eye remained while the sympathiser was passing through a severe inflammation; in all four the latter was absolutely lost, and had to be enucleated on account of pain. In one of these patients $V. = \frac{20}{30}$ and Jaeger 10, in another $= \frac{20}{40}$ and Jaeger 1 when corrected; in the others the exciter had been much damaged by iritis previously to the sympathetic attack, so that they had respectively only $V. = \frac{20}{100}$ and Jaeger 10, and $\frac{20}{200}$ and Jaeger 16. In Cases 9 and 10 the exciter was injured by accidental perforating wound; and, though it was inflamed rather severely along with its fellow, it was in neither case painful, so that the surgeon wisely forebore to excise it. In the one case it ultimately could read words of Jaeger 1, and in the other counted fingers at 7 feet. In all the cases in which the inflammation was severe in the sympathiser the exciter was lost, with the exception of four (Cases 8, 18, 30, 40); in two of these the final condition was excellent ($\frac{20}{30}$ and $\frac{20}{40}$). In four of the five cases of mild inflammation the exciter was lost, the exception being Case 22. In all these, however, the exciter was excised, as has already been remarked.

In three cases (12, 16, 28), and probably in a fourth (27), the exciter was lost from panophthalmitis, and in all the sympathising eye suffered severely.

VI. *Effects of Treatment.*

All those treated in the acute stage had *atropine* instilled several times daily with the exception of Case 2. In this instance the exciter had previously been operated on for glaucoma, and *atropine* was presumed to be therefore

contra-indicated as the inflammation was of a mild type; there was keratitis punctata with dots of lymph deposited at the pupillary edge, but no firm posterior synechiæ were formed, and vision was normal at the last examination.

A *dark silk bandage* was invariably worn during the inflammatory stage. *Leeching* was employed for the relief of pain, and, when this did not suffice, *morphia* was injected subcutaneously into the temple.

Mercury, pushed to mild salivation, was used in thirteen cases, including two of a mild, eight of a moderate, and three of a severe type. In both the mild and in several of the moderate cases it seemed to be of some service.

Operations.—In eleven cases *iridectomy* was performed on the sympathising eye. The details were shortly as follows:—

Case 2. Iridectomy at about the fourth week after outbreak, T. being +2. Followed by temporary relief of pain and by normal tension, but the sympathetic inflammation continued to run a very severe course.

Case 5. At the end of the third month, T. being +2, iridectomy was attempted, but no iris obtained: followed by normal tension but no improvement. Two months later the lens was removed and a piece of iris excised (see fuller account of this operation at p. 85); lymph afterwards gradually filled the coloboma. Eight months later (more than a year after commencement of inflammation), the eye then having T. -2, another iridectomy was done, a very little iris being obtained piecemeal. No improvement from any operation.

Case 8. Iridectomy at the end of the third month, a small piece only obtained; pain more severe afterwards. Nearly nine months later (about a year after outbreak), while T.n., another iridectomy done, leaving a good coloboma, with very considerable improvement in vision.

Case 12. Iridectomy about one year after outbreak, T. being +1; iris friable, and only small piece obtained; doubtful improvement. About two years and a half later,

a second iridectomy done; vision improved. About three and a half years again later, T. being +?, the lens was extracted; followed by iritis and deterioration of vision.

Case 15. About nine months after outbreak, T. being +1 with ciliary staphylomata, the entire iris and part of the lens were removed: the staphylomata thereupon flattened and T. became -. Eye subsequently shrunk, and sight was quite lost.

Case 20. About fifteen years after outbreak, eye being again inflamed and T. normal or +?, iridectomy was done; improvement in condition of iris and also slight in vision.

Case 21 (Lamellar Cataract). About four years after outbreak, T. being +1?, iridectomy; vision improved. Nearly five months later the lens was extracted with fairly good result.

Case 27. Iridectomy nine days after outbreak, a good coloboma being obtained; severe pain a few days later. About three months later, T. being +1, curette extraction of cataractous lens; T. soon became -1?, V. temporarily improved. Nearly three months later, T. being -1?, Weiss' scissors used to divide lymph in coloboma; marked improvement in vision.

Case 32. Five years after outbreak, T. being +2, iridectomy done and a little iris removed piecemeal; T. became normal, but vision was not improved.

Case 33. Iridectomy about twenty years after outbreak, and good coloboma left. Two months later, T. being normal, cataractous lens removed, but soft matter left behind; gradual absorption and improvement in vision. Four months later, T. being normal, iridectomy done, a large piece being obtained with Tyrrell's hook; no further improvement in vision.

Case 40. About one month after outbreak, T. being +2, iridectomy done; no improvement. About three months later, corneal section (Saemisch) through onyx that had formed; much pain necessitating excision of globe.

Case 42. Iridectomy at another hospital; date and other facts not obtained. Result not favourable.

In one case (10) iridectomy was done on the *exciter* five months after the commencement of the sympathetic inflammation; no improvement in vision, but eye not manifestly worse.

Sclerotomy was performed on the sympathising eye in two cases for relief of tension:—

Case 34. Five months after outbreak, T. being +1; relief of + T. and of pain. The eye subsequently became blind and shrunk.

Case 41. About seven months after outbreak, T. being +2, sclerotomy; temporary improvement in tension and in vision.

Other operations on the sympathising eye were only performed in two instances:—

In Case 18, about ten months after the outbreak, T. being normal, the iris and shrunken lens were divided with Weiss' scissors at the level of the pupil, with considerable loss of fluid vitreous; marked improvement in vision resulted.

In Case 1, paracentesis was done repeatedly with a broad needle through ciliary staphylomata to reduce + T.; pain seemed to be relieved temporarily by each operation.

As a result of the above analysis I should conclude—

(1.) That it is well to employ mercurials in all cases during the acute stage from the commencement.

(2.) That when and while the inflammation is of a very severe type treatment should merely be palliative, and no operative measures are warrantable.

(3.) That cases of moderate severity are best left alone (*i.e.*, without operation) for the first six months at least, but iridectomy may be then attempted if the tension is plus and the iris *bombé*. If at the end of a year the tension is about normal, but the pupil excluded and occluded, improvement may be expected from a large

iridectomy (when possible) with extraction of the lens, followed later by division of the lymph and opaque membrane with Weiss' scissors. Or the latter instrument may be used alone, part of the lens-substance being removed at the same time, and the rest left to absorption or subsequent curette evacuation if necessary.

VII. *Occurrence of Sympathetic Ophthalmitis after Excision.*

The onset of the disease was first observed subsequently to excision of the exciter in four cases (12, 33, 34, 35).

A very mild form of inflammation is, however, apt to be overlooked; and this was still more the case before our present more accurate method of examination with a high + lens behind the ophthalmoscopic mirror was introduced.* Case 36 is instructive in showing how easily a fallacy may occur from a severe relapse being mistaken for a first onset. Unfortunately none of the instances here given is beyond suspicion, with the exception perhaps of Case 34, and in it there is another source of fallacy in that the patient had a history of rheumatism.

In Case 12, according to the in-patient notes in 1869, the sympathising eye was unaffected at the date of excision of the exciter, and does not appear to have suffered for at least four days afterwards, as during this period the patient remained in hospital. The outbreak, however, probably occurred within a week after the excision at farthest, as the iritis was well developed on the eleventh day.

In Case 33 there is considerable doubt as to the sympathetic inflammation having really commenced after excision, but sympathetic "irritation" is alone mentioned in the notes of this date (1864). Subsequently the case seems to have been one of moderately severe sympathetic inflammation, probably with marked keratitis punctata, as a corneal nebula remained without any history of a previous corneal ulceration.

* As examples of a very mild form of the disease, see the cases detailed by Milles, *Trans. Ophth. Soc.*, vol. iii, p. 60.

In Case 35 there was well-marked sympathetic irritation at the time of excision. Next day there was conjunctivitis, and five days later ciliary injection, the pupil being still active, though oscillatory. It was not till four weeks after the excision that pain commenced and iritis was noted; he was under observation as an in-patient during the whole time. It must be observed that he was a rheumatic subject, and that the inflammation was at first of this type, but later it acquired more of the usual sympathetic character, ultimately leading to a bad result.

In Case 35 the date of the occurrence of the sympathetic ophthalmitis is dependent on the accuracy of the history given by the patient's parents, as the injured globe was excised at another hospital. From the statement thus obtained the second eye would seem to have been first affected "shortly after" excision.

VIII. *Miscellaneous Remarks.*

(a.) The history of the nature of the inflammation from which the exciter was lost is very imperfect in Case 3. Supposing it to have been a poisoned wound, as the patient stated, it is possible that a localised meningitis may have been the cause of the affection of the portio dura and auditory nerves on the same side.

(b.) The exciting eye was lost from *panophthalmitis* in three of the cases, viz., 12, 16, 28.

(c.) In several of the cases there was shooting pain complained of comparatively early in the affection, beginning on the side of the exciting eye and travelling across the forehead to the opposite eyeball and temple. This is by no means an uncommon history in sympathetic inflammation. (*See Cases 16 and 32.*)

(d.) The frequent recurrence of keratitis punctata in Case 25 is noteworthy. Previous to excision, attacks used to occur about twice in the year. Shortly after excision there was an attack, another about a year later, then others at intervals of two years, three years, three years again, and

one year. Though of moderate severity, the more recent attacks do not appear to have led to much deterioration of vision.

(e.) As noted in Case 34, the pupil of the sympathising eye was oscillatory previously to the outbreak of the inflammation. This symptom of marked oscillation or *jumping* is common in cases of sympathetic irritation, and I believe that in some instances it is the most prominent warning present, the other usual symptoms (photophobia, lacrymation, &c.) being absent or slightly developed. The mode of examination required is the same as that employed in testing the activity of the pupil to light; and the exposure once made is kept up while the observation lasts. Where oscillation occurs, the pupil, after responding promptly to the light-stimulus, almost immediately dilates again, then contracts nearly as much as before, then dilates wider, and continues thus to alternate, every now and again an especially wide dilatation being reached; the interval between the oscillations varies from between about a second to one-fourth of a second. Minor degrees of this wavy condition of pupil are comparatively common in cases of asthenopia, especially when due to hypermetropia or hypermetropic astigmatism, and also in persons of an excitable nervous temperament; but I have never observed in such cases the extreme oscillations occasionally met with in sympathetic irritation.

In this same case (34) the patient complained of intense headache and morning sickness, and I regret that his optic discs were not examined then, as the symptoms are precisely those so commonly met with in cases of intracranial disease associated with optic neuritis.

(f.) In at least two of the cases (36, 40) the lymphatic glands of the cheek or neck became swollen during the ophthalmitis.

(g.) In one case (29) the iritis was accompanied by pus in the anterior chamber, a comparatively rare association in sympathetic inflammation.

Doubtful Cases.

It may be urged that the recording of doubtful cases is unnecessary. It is clearly injudicious, however, to reject all cases except such as conform strictly with our previously formed notions of this disease, and these were all sufficiently like to be judged sympathetic on first admission. It is from doubtful cases, indeed, that we sometimes learn exceptional facts which may perhaps enable us reasonably to modify our views concerning the disease under consideration. Care must, however, of course be taken not to lay too much stress upon such cases, and I have therefore not included them in the previous remarks.

Case 44. The interval here is a very long one, but the condition of the lost eye is similar to what we not infrequently find in an exciter of the disease after a long interval. Though there was corneal ulceration, the iritis was apparently older in date. It is intelligible, too, that the nutritional changes consequent upon an irido-cyclitis may predispose to corneal suppuration; we have an instance of such an association in Case 40 given above.

Case 45. In this case the sympathiser would seem to have suffered from a previous corneal ulceration, but the condition of the iris on examination was very suspicious of a recent iritis of the usual sympathetic type, and the attack would seem to have followed the blow causing pain in the exciter.

Case 46. This appears to have been probably a case of rheumatic iritis. The history of the attack in the left eye is very imperfect, but would suggest corneal ulceration in childhood, followed by irido-cyclitis (? rheumatic) in late middle life. The attack of so-called "glaucoma" in the right was probably a first attack of iritis in this eye. This patient had well-marked duboisine delirium.

Case 47. There is little doubt as to the sympathetic nature of the affection in this instance, but the details are meagre. The sympathetic inflammation seems to have

commenced a few months after the injury to the exciter, and apparently ran rather a severe course, probably leading to complete blocking of the pupil. It was judged necessary to remove the lens from the sympathising eye three years later, and a moderately good pupil was obtained with useful vision.

CURATOR'S PATHOLOGICAL REPORT.

By J. B. LAWFORD, F.R.C.S.

Cases of Dislocation of Crystalline Lens.

CASE I (Reg. No. 1733).—*Dislocation of Lens: Secondary Glaucoma with intercurrent attacks of pain; Retinal Hæmorrhages; Changes in Optic Nerve.*

Male, æt. 62. Blow on left eye by piece of wood twelve months before admission. Sight failed very rapidly, and in one month after accident, eye was blind. During that time he had severe pain, and has been subject to short similar attacks ever since. On admission, Right eye healthy; Left, slight ciliary injection; cornea, hazy; pupil, dilated and inactive; no p. l.; T. + 3.

Left eye excised: examined at once.

Cornea of normal appearance, except that there is some loss of transparency. *A. C.* of moderate depth, but encroached upon by adhesion of iris to cornea at periphery, especially on temporal side. *Lens*, which is clear, is displaced downwards and outwards, and rests against ciliary processes at that part; the suspensory ligament has given way at other parts of circumference of lens, so that its upper edge is freely movable when eyeball is moved. The *iris* and *ciliary processes* are atrophied; the uveal pigment near the root of iris, has disappeared over several small areas. *Vitreous* clear, but with slight loss of consistence.

Retina in situ; in y.s. region a group of small hæmorrhages, roughly circular in shape; and three similar extravasations on nasal side of disc. Veins very full. *O.D.* slightly cupped.

Choroid apparently healthy.

O. N. sheath is dilated immediately behind the eyeball.

Microscopic Examination after Hardening.—*Cornea*, thin but exhibits no structural change. *Iris*, greatly atrophied, especially in peripheral half. There is close adhesion of iris to

cornea at iris-angle, this adhesion being of noticeably greater extent at the temporal side, over the area on which the displaced lens presses. A migration of uveal pigment into the cornea has taken place at this part, and the pigment cells have collected around Schlemm's canal. This change has occurred only at lower and outer part. There is slight ectropium of uveal pigment at pupillary edge. The *ciliary muscle* is much degenerated, its bundles of fibres (especially the circular) being largely replaced by fibrous tissue. This degeneration is more evident on temporal side. The *ciliary processes* are considerably atrophied.

Lens hardened, measures 4.25 mm. and 7.75 mm., in its antero-posterior and transverse diameters respectively.

Retina. There is atrophy of nerve-fibre and ganglion-cell layers. The ganglion cells have in some places entirely disappeared. The hæmorrhages are nearly all confined to the three innermost layers of retina, but some have extended as deeply as the outer granule layer, but have not penetrated it.

The *optic papilla* is slightly excavated, the nerve fibres in front of the lamina cribrosa being so atrophied as to be scarcely recognisable, and the central retinal vessels are left exposed. The retinal vessels, where cut across in the sections, are all full of blood; their walls are little if at all thickened, but have a suspicious hyaline appearance, as if degenerate. No evidence of thrombosis obtained in the specimens. The portion of the O. N. removed with the eyeball (about 4 mm.) exhibits considerable change. The nerve-fibre bundles are atrophied, and there is a proportionate increase in the amount of fibrous tissue. The inner sheath is thickened, and the intersheath space, which is larger than normal, contains some apparently thickened loose fibres, and a number of small concentrically striated bodies, like the corpora amylacea often found in the meninges of the brain. There is no increase in the number of small vessels throughout the nerve; those present exhibit slight thickening of their walls, which have an hyaline appearance; but without any concentrically arranged fibrous tissue around them, such as Brailey and Edmunds* describe. These changes are most marked immediately outside the lamina cribrosa, but extend to the cut end of the nerve.

* Ophthalmic Hospital Reports, vol. x, Part I, p. 86.

CASE II (*Reg. No. 1765*). — *Wound of Cornea; Dislocation of Lens; Hæmorrhage from Ciliary Body and Choroid; Commencing secondary Glaucoma.*

Male, æt. 66. Left eye struck by a 2" nail nine days before his admission to hospital, on March 25th, 1885. When admitted, the notes are: Right eye, healthy; Left eye, V-shaped scar in cornea at upper outer margin. P. dilated, circular. Lens dislocated upwards and outwards. T + ?. V = fingers at 3".

Severe pain came on and T. became +1. Eye excised April 9th.

Examination after Hardening.—*Cornea* curvative irregular; upper and outer parts thickened and slightly bulged forwards, at site of wound. *Iris*, very narrow, thick; adherent to peripheral part of cornea, blocking the iris-angle. *Lens* dislocated upwards and outwards behind the ciliary processes, against the inner surface of which it rests. Its lower and inner edge is slightly tilted forwards and is just below the centre of the pupil. There is a thin lamella of opacity in the lens, both the nuclear and cortical parts being clear. A delicate band comes forwards from vitreous below its edge, and is adherent to cornea at lower end of the scar. *Vitreous* clear, slightly shrunk and detached from retina posteriorly. The *retina* is in contact with choroid everywhere. No hæmorrhages in it. At equator, below, there is a shallow detachment of choroid and retina from sclerotic; the space is filled by blood clot.

Microscopic Examination.—Scar in *cornea*, at upper part, through its whole thickness; it is filled by new tissue with many nuclei.

The *iris* is contracted and narrow, but thick, and is adherent to the cornea at periphery, following closely the slight irregularities of its posterior surface. On the temporal side, where the lens has rested against its root, the iris is thin and atrophic; but towards pupillary border it becomes thick again, and is of greater thickness than the corresponding part on opposite side of pupil. This very marked contraction of the iris has given rise to abnormally deep grooves or folds on its anterior surface. There are very slight signs of inflammation in it.

The *ciliary muscle* and *processes* show no structural change,

except in one part, on which the lens rests; here hæmorrhage has occurred between ciliary muscle and sclerotic, separating them, and the blood has penetrated among the fibres of the muscle.

At lower part, the band stretching forwards from vitreous originates in that portion adjoining the ciliary processes, and passing close to lower border of the displaced lens, becomes adherent to the cornea at the lower end of the cicatrix. It is composed of homogeneous fibres, which stain badly, and closely resemble the fibres of the suspensory ligament of the lens. It appears to support the lower edge of the lens.

The *lens*, which is of normal shape and size, rests by about $\frac{1}{3}$ of its anterior surface against the ciliary body, the remainder of its anterior surface being free in the pupil. There is no discoverable wound of the capsule, nor any noticeable alteration in the lens-fibres.

The *vitreous* is shrunken, but shows no inflammatory signs.

The blood-vessels of the *retina* are all full. No pathological changes found in this coat or the *choroid* (except the hæmorrhage previously mentioned), but in several places the pigmented epithelium tears away with the retina from the choroid, looking as if there had been some slight inflammation. The *optic papilla* and *nerve* appear healthy.

CASE III (*Reg. No. 1806*).—*Dislocation of a Cataractous Lens during Violent Coughing; no Symptoms during twelve years; then Attack of Pain and Increase of Tension.*

Male, æt. 67. Fifteen years before admission the sight of left eye failed gradually without any assignable cause. It remained "quite blind" for three years. Patient thinks there was "a cataract on the sight." Then after a violent fit of coughing he found he could see with that eye. He retained the full amount of sight thus recovered for nearly 12 years, and the eye never gave him any trouble. A fortnight before admission he "caught cold" in left eye; severe pain supervened and sight failed. On admission: R. $\frac{20}{20}$. L. counts fingers at 18"; cornea hazy, A. C. deep, iris tremulous; lens seen in lower part of vitreous; T +1 or 2.

After excision the eyeball was divided into anterior and posterior halves.

The *lens*, which is opaque and slightly shrunken, lies at lower part of eyeball, against inner surface of retina, a short distance posterior to ora serrata. There is no naked eye change in the *vitreous* over it; in the *choroid* there is a single patch of atrophy, with pigment accumulation at its margin, close to but slightly anterior to the position of the lens. The *retina* and *choroid* elsewhere both look quite normal.

The A. C. is filled by coagulated soft semi-transparent effusion. The *cornea* and *iris* exhibit no naked eye change; the *ciliary processes* are not evidently altered.

Microscopical Examination.—*Cornea.* No alteration in its substance; at limbus there are very numerous vessels, with some small cell accumulation beneath conjunctiva. The A. C. in the sections, contains some portions of the coagulum which filled it; these consist of a very fine fibre-network with some faintly granular material. Adhering to the post surface of the cornea are several groups of large rounded granular cells, each with a single, usually central, nucleus; similar cells are present on anterior surface of iris, in considerable numbers, and a few are seen on inner surface of ciliary processes and pars ciliaris retinæ. The angle of A. C. is large, and there is no sign of adhesion of iris to cornea. Among the trabeculæ of the ligamentum pectinatum, in the spaces of Fontana, are considerable numbers of small staining cells, which also extend to and surround Schlemm's canal. The corneal portion of the ligament is more than usually prominent, partly perhaps from traction by the iris, which is at a greater distance from it than in an eye with an A. C. of normal depth, and partly from the collection of cells in large numbers among its meshes.

The *ciliary muscle* has undergone very little change; a few of the bundles of circular fibres have degenerated and are replaced by a fibrous tissue. There are no inflammatory signs in it. The *ciliary processes* though perhaps slightly too prominent are not (microscopically) inflamed.

The *iris* appears healthy; there is no membrane in the pupil.

Close to the spot at which the lens lay, the *retina* and *choroid* are slightly adherent; and at the patch of atrophy

mentioned above, the *choroid* is reduced to a very thin layer, with much pigment heaped up around it. Elsewhere both these coats show no evidence of pathological change.

The *optic nerve* and *papilla* are healthy, and the central retinal vessels are free from inflammatory signs.

The physiological pit in O. D. is filled by a material consisting of numbers of small leucocyte-like cells, and a few larger granular cells, with some fibrillated structure; the whole mass probably being altered vitreous. Similar material is adherent to retina in neighbourhood of optic papilla. The bulk of vitreous was unfortunately lost, so that no microscopical examination of it was made—but the appearances at the disc render it probable that it had undergone some degeneration and cell infiltration.

CASE IV (*Reg. No. 2021*).—*Perforating Wound at Sclero-corneal Junction; Entanglement of Iris; Wound and Dislocation of Lens; Severe Plastic Inflammation; Onset of Sympathetic Ophthalmitis seven weeks later.*

Female, æt. 43. Blow on right eye by handle of a mangle 13 weeks before she came to hospital. Sight lost "at once." The injured eye gave her very little pain, and she only applied for advice on account of failure of the left eye for the past six weeks. On admission: Right, shrunken and becoming squared; cornea steamy, shallow A. C. On inner side just beyond corneal border are two prolapsed portions of iris; iris wanting in inner half. Lens not quite clear. T. —. Left, sympathetic ophthalmitis. Right excised and opened by antero-posterior section.

Cornea irregularly thickened. At its nasal border is the scar of a wound, at the upper and lower ends of which there is a small prolapse of iris. This scar externally is just at sclero-corneal junction; its course is oblique, so that internally (on posterior surface of cornea) it is well in corneal tissue. The *iris* is entangled in whole length of the scar, but only shows externally at its extremities.

The *lens*, which is bulky, approximately spherical in shape, and partially opaque, is dislocated. It lies obliquely, its inner edge being displaced inwards and forwards, and is in close apposition with cornea, iris, and ciliary body. Between the

lens and cornea on temporal side, the iris intervenes. The ciliary processes are apparently swollen and the choroid thickened. On its inner surface, in temporal half of eyeball is a layer of grey jelly-like material, which separates the *retina* from the *choroid*. Elsewhere the two coats are in contact. The *papilla optica* is prominent; *vitreous* fluid in greater part.

Microscopic Examination.— In the neighbourhood of the wound (*b*) the *cornea* is infiltrated with small cells, and slightly increased in thickness. The wound is occupied by tissue containing large numbers of nuclei and some pigment, and evidently consists chiefly of iris, though it is unrecognisable as such. The *ciliary muscle* and *processes* adjoining the wound are much disorganised. The *iris* at temporal side is between the displaced lens and the cornea, with both of which it is in contact. It is inflamed, and the uveal layer considerably disturbed. On its posterior surface, between it and lens capsule, is a thin layer of new tissue; this passes over the root of iris and tips of ciliary processes and round the edge of lens, then extending across (*a*) close to posterior lens capsule, it becomes continuous with the scar tissue and the cornea on the nasal side. In this tissue, which consists of well-formed long fibre-cells, some new vessels are developing behind the lens. The



lens has been wounded on the inner side just behind its equator, and the fibres are, at this part, much degenerated. Similar changes are extending along cortical layers, chiefly beneath posterior capsule. The *choroid* is intensely inflamed, and thickened throughout. It is packed with small cells. Its inner surface is corrugated, and shows here and there small colloid outgrowths. The pigment epithelium remains adherent to choroid. The *retina* is inflamed, but far less severely than

the choroid. The *O.D.* is swollen, but there is very little hyper-nucleation either at the papilla or in the portion of nerve removed. In the intersheath space close to eyeball there is slight noticeable increase of tissue.

CASE V (*Reg. No. 2032*). — *Wound of Conjunctiva and (non-perforating) of Sclerotic. Dislocation of Lens between Ciliary Body and Sclerotic.*

Female, *æt.* 38. *Right* eye struck by a clasp knife thrown at her 12 days previously.

When admitted to hospital the following notes were made. R. Blood in A.C. P. widely dilated. No reflex from fundus. V. = hand reflex. T.n. A fleshy granulation on conjunctiva at lower part. L. My. — 5 D., otherwise n. After removal of the R. eye there was found to be a moderate amount of hard irregular thickening on the external surface of the sclera at lower part of globe, surrounding the insertions of inferior rectus and inferior oblique muscles. On dividing the eyeball, the following conditions were observed:—*Cornea* unaltered. No scars of wound discoverable. Some blood clot in A.C. *Lens*, which is of normal shape and nearly clear, lies against sclera and sclero-corneal junction at lower part; the lower two-thirds of its anterior surface being in apposition with the sclerotic; the upper one-third projecting into A.C. (*see* Woodcut). It measures 4 mm. antero-posteriorly, and 8.5 mm. transversely. On its posterior surface the ciliary body and iris rest, the latter thickened, and contracted to a very narrow rim.

The *ciliary body* is torn from the sclerotic all round, but the separation is very slight except where the lens intervenes. The *retina* and *choroid* are in apposition throughout; but the latter is separated from the sclerotic at equator below, by some blood clot. The *vitreous* contains some blood, and about the lens and ciliary processes at lower part a small quantity of coagulated blood is lying.

Microscopic Examination.—The posterior half of eyeball was unfortunately lost. The *lens capsule* is apparently intact, and the lens fibres show very little change, but some degenerative process is beginning at the central part. The attachment of ciliary muscle and iris to sclerotic is completely broken through.

The ciliary muscle and iris are contracted and thick, and the latter contains some extravasated blood. A thin layer of blood covers the anterior surface of vitreous. The iris where not in contact with lens is rather less contracted and puckered. Its



origin has been ruptured in whole circumference. No inflammatory signs are present except in sclerotic and episcleral tissue at lower part. The sclerotic here contains numbers of small staining corpuscles, and on its outer surface is a moderately thick layer of tissue (*i*), consisting of an irregular fibrous network with numerous nuclei and connective tissue corpuscles; it is not very vascular. No trace of perforating wound discovered. In anterior part of sclerotic below, at a point corresponding to the granulation on conjunctiva is a small scar, well healed, and only extending half-way through the sclera.

The above cases, in which displacement of lens occurred, offer several points of interest and doubt. In Case 1 a not unusual form of dislocation of the lens gave rise, as it so frequently does, to a secondary glaucoma with macroscopic and microscopic changes, typical of increased tension, of some duration, whether primary or secondary. The blocking of the iris angle must have occurred first, at that part upon which the displaced lens exerted pressure. By interfering with free drainage over this area, more work would be thrown upon the excretory channels in the angle of the anterior chamber in the rest of its circumference; and although this angle (from the absence of the lens behind a large part of the

iris) must have been larger than normal, the task proved too severe, and the iris was forced forwards against the periphery of the cornea, to which it became adherent all round. A sufficient degree of tension to obliterate sight appears to have been established within a month of the accident. The hæmorrhages in the retina were recent; and there were no traces of former extravasations. In Case 2 a similar displacement had occurred, and like conditions were apparently being set up. The eye was excised 14 days after the injury, yet already adhesion of the iris to cornea at periphery was evident.

Case 3 is one of some rarity. The lens, which was probably cataractous and slightly shrunk, became dislocated into vitreous during violent coughing; and during a period of 12 years it gave rise to no symptoms. The pain and other symptoms which brought the patient to hospital were attributed to "cold," and though he stated that the sight of the eye had failed, there was no evidence that it had been previously any better than on admission, when it was about as good as might be expected in an aphakic eye. The cause of the increased tension is doubtful; there was no adhesion of iris and cornea to block the angle, but there was a noticeable cell aggregation in the meshes of the ligamentum pectinatum and about Schlemm's canal, which might not unreasonably be expected to, at least, retard the outflow in this situation.

In Case 4 the changes found after excision must be attributed less to the effect of a dislocated lens than to the perforating wound, and the probable introduction of a *materies morbi*. The inflammatory processes which ensued were of a plastic nature, and new tissue developed, forming a layer (shown in the Woodcut) which encircled the crystalline lens. In the posterior part of the capsule, behind the lens, new vessels were found in process of development; a condition, I believe, not very often met with.

Case 5 is an example of a rare form of displacement, and it is not easy to understand from a mechanical point of view how such a dislocation could occur. The fact that the anterior attachment of the ciliary muscle and iris were broken through in the whole circumference, favour the inference that the lens, which had been dislocated into the A.C., had simply slipped into the space between the choroid and sclerotic at the most dependent part; but I am disinclined to think so, as the lens was so firmly held in its new position, that it could not be shaken back into the anterior chamber immediately after removal of the eyeball. The eye was presumably myopic (the L. eye had My. of 5 D.), and the attachment of iris and ciliary muscle would be weaker and more easily ruptured than in an emmetropic or hypermetropic eye.

In Vol. I of the "Ophthalmological Society's Transactions," Mr. Nettleship has recorded a case, in which an opaque lens disappeared into a pouch, apparently between the choroid and sclerotic *at the upper part*, when the patient lay down, and slipped back into the A.C. on his resuming the erect position. There was a history of a blow some years previously. It is possible that in this instance a dislocation similar to that of Case 5 had occurred, and that as time went on, the lens became so much shrunk that it was able to escape from its nest between the sclerotic and ciliary body, and appeared in the anterior chamber. Such might have been the ultimate result in Case 5 had the eye not been removed.

NOTES ON IN-PATIENTS.

By E. TREACHER COLLINS,

*Senior House Surgeon, Royal London Ophthalmic Hospital.*I. *Four Cases of Interstitial Keratitis, with Ulceration of Cornea.*

THE following are the notes of four cases of an unusual type of interstitial keratitis, all of which commenced with opacity of the cornea, followed by intense vascularity, beginning at the margin and gradually extending all over, until ultimately only a small central island of non-vascular structure was left. This central patch became yellow, and afterwards ulcerated; in one of the cases the ulcer perforated, in the others it cicatrised. The vascular part of the cornea gradually cleared up, but the central portion remained permanently opaque. In all four cases there were unmistakable signs of inherited syphilis, either in the teeth or in the physiognomy. Mr. Jonathan Hutchinson, in his book on "Syphilitic Diseases of the Eye and Ear," has recorded and pictured one somewhat similar case, in which he says, "there appeared to be a deposit of pus in the centre of the cornea between its layers. The whole surface of the cornea was of deep cherry-red colour, from the interlacing of minute vessels," and he goes on to say, "so acute an inflammation of the corneæ as occurred in this instance I have never before witnessed in connection with hereditary syphilis. The girl's feeble health and under-fed condition, taken together with the exhibition of mercury in such doses as to be a powerful depressant, ought probably to be made to explain this unusual severity."

In the following cases, however, all the patients were robust, and had not been subjected to large doses of mercury previous to the appearance of the acute symptoms.

CASE 1.—Matilda W., a well-nourished, rosy-cheeked girl, with prominent frontal eminences, a depressed bridge to her nose, and scars about the angles of her mouth, but regular, well-formed teeth, *æt.* 10, came to the hospital first on New Year's Day, 1885, under Mr. Lawson. Both corneæ were hazy and infiltrated, and at the margins were very fine networks of blood-vessels, which gradually encroached on all sides towards the centre of the corneæ. On March 16, central ulceration of both corneæ was noted, the remainder being everywhere vascular. At the beginning of April the ulcer in the right eye perforated, and on October 4, 1886, the right cornea was staphylomatous and opaque; the eye painful, T. + 2; no perception of light. It was excised on October 12.

In the left eye the peripheral part of the cornea had cleared, but there was still a central leucoma, the pupil was active, and she could count fingers at two feet.

CASE 2.—Theresa K., *æt.* 6, came first as an out-patient to Mr. Lang, on January 27, 1886. There was no specific history from the father, but the child was born puny; had had snuffles and a sore bottom; the next child, older, also had had snuffles. On admission into the hospital, on March 4, 1886, there was a sloughing central ulcer in the middle of each cornea, and both corneæ were completely vascular, and the T.—. On March 18 the ulcers were healing, and the periphery of the corneæ had commenced to clear; the tension of the left was still minus; that of the right normal. On April 12 the periphery was clear in both, but dense central opacities, larger in the left, remained. T. normal in both.

CASE 3.—Henry J., *æt.* 21, has a markedly concave physiognomy, and very typically notched teeth; his lower jaw is so bent and prominent, that with his mouth shut there is fully a space of half an inch between his upper and lower incisors. He came as an out-patient to Mr. Gunn first on May 19, 1886. His right eye had then been bad three weeks; there was considerable ciliary injection, and the cornea was uniformly semi-opaque, like ground glass. In the left eye, which had been bad only four days, there was a haze of the cornea, and a vascular patch at the lower part. He was treated as an out-patient, taking hydr. $\bar{c}$.

cret. in pills, and having atropine ointment and warm boracic acid bathing locally. The vascularity of the cornea had increased considerably by June 12, when he was admitted into the hospital; he was then given hydr. c. cret. in pills twice a day, which soon began to salivate him, and ung. atropiæ sulphatis grs. iv to ʒi, to be put into his eyes three times a day. The atropine caused swelling and redness of the lids, and duboisine had to be substituted. The corneæ became uniformly vascular and ulcerated in the centres, but they healed without perforating, and the corneæ ultimately cleared up, leaving dense central opacities, which were still present on October 8, 1886.

CASE 4.—Walter R., æt. 14, came into the hospital under the care of Mr. Tay, on August 18, 1886. His teeth were very irregular and small, but not notched; his physiognomy was suggestive of hereditary syphilis. Inflammation had commenced in the left eye seven weeks previously; the cornea was then hazy all over, with a ring of vascularity all round, most marked above, where it extended 3 mm. within the sclero-corneal junction. In the right eye there was a white patch on the anterior capsule of the lens, and one posterior synechia, but no history of inflammation in that eye could be obtained. On August 30, the cornea was vascular all over, except the central part, which was staphylomatous. On September 17 a central yellowish ulcer, with distinct loss of substance, was noted, and the periphery had begun to clear. When last seen in November, the ulcer had healed, leaving a dense central opacity, and the periphery of the cornea was quite clear.

II. *The Treatment of Granular Ophthalmia with Carbolic Acid.*

So intractable a disease as granular ophthalmia has necessarily from time to time had many and varied forms of treatment tried for its cure. Of the numerous caustic preparations that have been used, nitrate of silver and sulphate of copper continue most in favour. Of late I have in several cases applied pure carbolic acid just liquefied, and believe it to be quite as efficacious as these caustics; it has this advantage also, that its application is

a much less painful procedure, on account of the local anæsthetic action possessed by carbolic acid. Further, it does not stain the conjunctiva when used for a prolonged period, as is the case with nitrate of silver. I paint it on the inner surface of the everted eyelids with a camel's hair brush, at intervals of one or two days, applying it more particularly at the seat of the granulations. I then syringe any excess off with a stream of water, being careful not to let the undiluted solution go either on the cornea or skin. The surface of the conjunctiva is turned white, and in a minute or two rendered anæsthetic; a slight amount of inflammation is set up, and destruction of the epithelium follows. Absorption of the granulations is stimulated, and the trachoma-coccus (supposing such to exist) is doubtless killed by the carbolic acid.

III. *Statistics of Cases of Extraction of Cataract before and since the Introduction of Cocaine.*

So much has been said and written of late on the evil effects of cocaine, that I think it may be interesting to make a comparison between the cases of cataract extraction occurring in the hospital during the year 1883, before the introduction of cocaine, and those treated in 1885, when cocaine made up with a saturated solution of boracic acid was used in almost all cases. In making this comparison, I have counted the number of cases of panophthalmitis, the number of cases of loss of vitreous, and the number of cases of severe iritis, with the following results:—

In 1883 there were 225 cases of extraction of senile cataract; 14 supplicated, or 6·2 p. c.; 32 cases lost vitreous, or 14·2 p. c.; and 16 cases had severe iritis, or 7·1 p. c. In 1885 there were 264 cases; only 3 supplicated, or 1·13 p. c.; 22 cases lost vitreous, or 8·3 p. c.; and 9 cases had severe iritis, or 3·49 p. c.

Mr. Morton, in the Royal London Ophthalmic Hospital

Reports for 1879, Vol. IX, published the results of 146 cases of extraction of cataract occurring in 1875 and 1876; of these 8 suppurated, or 5·47 p. c.; 6 lost vitreous, or 4·1 p. c.; and 18 had severe iritis, or 12·3 p. c. These figures speak for themselves.

MISCELLANEOUS CASES AND OBSERVATIONS.

By W. J. COLLINS, M.D., M.S., B.Sc. (Lond.).

Clinical Assistant to the Hospital.

Paralysis of External Ocular Muscles in Child aged Seven. No other Paralysis. Slight Cerebral Symptoms. Coma. Death in Five Weeks from First Symptom.

Agnes K., æt. 7, daughter of a coachman, a delicate child, complained on April 22 of sudden diplopia, and her mother noticed she squinted. On April 30 she was brought to Moorfields; there was then well-marked paralysis of the left external rectus and superior oblique muscles, the secondary deviation exceeding the primary. There was no other paralysis. The sight of the left eye had got rapidly worse since the supervention of the diplopia, and was now reduced to bare p. l.; the media were clear; the optic disc exhibited a misty outline, and the veins were tortuous; there was well-marked shot-silk appearance of the retina, and nothing else abnormal. On being questioned the mother said she had noticed the child had been more drowsy than usual, and at times sick; she had also complained of pain in the left brow. Otherwise, though delicate, the child was apparently sound. The right eye V. = $\frac{6}{6}$, and J. l. The mother was warned of the possibility of danger, and advised to send for a medical man should any head symptoms arise. The child attended weekly until May 21, with but slight, if any, change in the symptoms, beyond some increase of the neuro-retinitis; on that day she was comatose in the evening, and Mr. Strugnell, of Highgate, was called in. He has kindly informed me of the subsequent history. The temperature never exceeded 101°; there were no convulsions of any kind; the coma deepened; on tickling the soles of the feet the legs were drawn up after a marked interval. The symptoms, he thought, pointed more to tumour than to meningitis. The child died on May 27. No *post mortem* examination was made.

A closely similar case to this, in a child aged 5, which was under treatment at the same time, completely recovered. Small doses of hyd. c. cret. and of pot. iod. were prescribed.

The possible gravity of ophthalmoplegic symptoms occurring in a child would appear to be greater than in adults, in whom the prognosis is usually very favourable, most cases yielding to continued treatment with iodide of potassium.

Feigned Monocular Blindness in a Girl aged Nine.

L. E. W., æt. 9, from Henley, came to the hospital on August 9, complaining that the right eye was blind; this had "prevented her attending school more than three days in the last six months." Her manner was suspicious, and her physiognomy not reassuring. She answered hesitatingly, and was prone to tears when pressed to answer questions. The eye was fully examined under homatropine, and nothing abnormal was discovered; there was no strabismus. With a prism diplopia was readily conceded, and the red and green letters were fluently recognised through the red and green spectacles. Her mother repudiated the suggestion of deceit, and protested that if her left eye was covered she could not find her way by herself. This done, she did not fall over or encounter any obstacle, but waved her hand feelingly in front of her, and skulked along, all the while keeping a sharp look out with the "blind" eye on those watching her.

Cataract Twenty-four Years Maturing.

William W., æt. 85, brings out-patient letter, bearing Sir W. Bowman's name, and the date 24th July, 1862, on which it is noted, "L.E., cataract mature, fingers within 6 inches; R.E. words of No. 2, myopic"; on September 18, 1883, there is a note, "J. 1 at 4 inches; R.E. J. 10 at 6 inches."

On September 21, 1886, the cataracts in both eyes were partial and immature; the left has a very dense white nucleus and cortical striæ, occupying all except the uppermost part; likewise in the right the upper part is alone clear. Through these gaps the fundus of each eye could be seen, and a large staphyloma discovered round each O.D.

An Argument in favour of Meridional Accommodation.

A girl, æt. 19, from Port Elizabeth, complained of myopia, for which she had been ordered — 6 D. glasses for all purposes, but these did not relieve her asthenopia. By retinoscopy it was found that these spectacles overcorrected the myopia in all meridians, and — 2 D. in the horizontal, and — 5 D. in the vertical were the correcting lenses. On testing her with the types her vision was $\frac{6}{60}$ only with each eye, and with — 2 D. barely $\frac{6}{18}$, but on adding — 3 D. cylinders with the axes horizontal, it was improved to $\frac{6}{9}$. After being in the dark room a short while, on returning to the types she could read $\frac{6}{9}$ with a — 2 D. spherical, without any cylinder, but with obvious and much complained of effort; suddenly the visual acuity dropped to $\frac{6}{24}$, but was at once restored by adding the cylinders formerly tried, and this was maintained without the slightest effort. These observations were repeated with other test-types, to eliminate the possibility of error, and the patient, who was very intelligent about her symptoms, was keenly sensitive to the advantage of the correction of the astigmatism, and of the increased effort to rectify vision in the absence of the cylindrical glasses.

This case is important and instructive, and the lesson it teaches needs to be borne in mind in the estimation and correction of astigmatism. It would seem that inequality of meridional refraction, which is corneal and static, is capable of more or less perfect correction by meridional accommodation, which is, of course, lenticular and dynamic.

Persistent Capsulo-pupillary Membrane.

Francisca S., æt. 21, complained of asthenopia, and on superficial examination the right eye presented an adhesion between the lens-capsule and the iris. On closer observation it was found that starting from a point just below the centre of the lens capsule, and passing downwards and slightly inwards,

behind the inferior internal quadrant of the cornea was a delicate fan-shaped filamentous structure, connecting the lens capsule with the circulus minor of the iris, on the anterior aspect of the latter. The iris was blue, and the radial fibrils of this membrane presented a lighter tint of the same hue. Vision with the right eye = $\frac{6}{9}$ c + 1 D. = $\frac{6}{9}$. The other eye is normal, and V. = $\frac{6}{6}$.

The patient is certain she never had any signs of inflammation in the eye, and that the condition described has obtained all her life.



There can, I think, be no doubt that this is an example of the foetal membrana capsulo-pupillaris persisting in the adult. This membrane is, of course, to be distinguished from the membrana pupillaris, the vestigial filaments of which pass diametrically across the circulus minor of the iris. This distinction is not insisted upon in most English works, but is well brought out in Müller's *Physiology* (Vol. II, p. 1632), based upon the descriptions of Henle, Krause, and other observers. In this case the capsular origin of the filaments was, as stated, from the neighbourhood of the anterior pole, but it would appear that the foetal membrana capsulo-pupillaris is equatorially attached at its origin and to the pupillary margin at its insertion. This may be explained by partial adhesion of the membrane longitudinally to the capsule of the lens prior to its reflection forwards, and indeed one delicate thread, separate from the rest, did proceed from a point nearly midway between the pole and the equator of the lens. The adhe-

sion to the circulus minor of the iris, and not to its margin, is explicable on the ground of fusion with the posterior lamella of membrana pupillaris, which fusion is, according to Müller, by no means unusual, and often inseparable.

Failure of the Accommodation dependent on Prolonged Lactation.

I have recently published in the Lancet (November 6, 1886), a series of cases of cycloplegia or cyclopareisis arising during the puerperal state, or during lactation. Within the last twelve months I have taken notes of ten such cases among out-patients of Mr. Lawson's. The last case which presented herself was highly typical of the class, and was not included in my former paper.

Sarah N., æt. 40. Has had eleven children; the last is eighteen months old. She is still nursing this one, and she nursed all the others for an equally long period. Her eyes have been failing of late, and during the last five weeks she has been quite unable to read small print, or do fine work. $V. = \frac{6}{12}$ each eye, and is not improved by any glasses. She cannot neutralise even -2 D., only reading $\frac{6}{24}$ through them. She can make out only J. 4, when held at 22 cm. and not J. 1 at any distance. With $+2$ D. she reads J. 1 at 22 cm., and ten minutes after the instillation of eserine she can do the same without assistance. The pupils are equal and active, about 3 or 4 mm. in diameter. There is no change in the fundus, and no appreciable amount of hypermetropia could be found with the ophthalmoscope.

The treatment of these cases is simple, and always successful. Weaning the child, good diet, and a tonic being, in the absence of hypermetropia, all-sufficient. Weak eserine drops are sometimes useful.

The cycloplegia of lactation is most common in young multiparæ, in hypermetropes, in those naturally delicate or otherwise debilitated. It is seldom complete, the iris is rarely affected, the visual acuity is a little subnormal, and the fundus beyond being anæmic, is healthy.

NOTE ON CERTAIN RETINAL REFLEXES VISIBLE WITH
THE OPHTHALMOSCOPE.

By R. MARCUS GUNN, M.B., F.R.C.S.,

Assistant Surgeon to the Hospital.

OPHTHALMOSCOPIC observers have long been familiar with the peculiar shifting reflex often met with in examining the eyes of young people, known as the "shot silk," or "watered silk" retina. Minor degrees of this condition are very common, but occasionally we find the shimmer particularly brilliant, playing over the inner surface of the retina with every movement of the mirror or of the patient's eye, now on one side of the larger vessels, now on the other, and often partially or even completely obscuring the vessel itself for a short distance. The extent of the brightly reflecting area associated with any one blood-vessel will be found to vary much in different parts of the vessel's course, apart altogether from movements of the mirror or of the patient's eye. The inner edge of the bright band is usually very near but not quite continuous with the vessel, while the band itself is sometimes quite narrow, sometimes extends for a considerable distance, and ultimately perhaps joins a similar reflex in association with a neighbouring vessel. On tilting the mirror the reflex may be made to flash across from one to the other side of the vessel, where similar variations in the breadth of the illuminated band may be observed. If a vertical vessel be regarded by the direct method the reflex will be seen on the same side of the vessel as that from which it is illuminated.

A somewhat similar retinal reflex, but always narrow in this situation, may be observed to map out the region of the macula, describing an elongated oval with its long axis horizontal.

These reflexes are best seen in a dark fundus, using a

highly concave mirror by the direct method. I do not recollect ever to have seen them well marked except in cases of hypermetropia; certainly never in high myopia. Schirmer* was, I believe, the first to describe these appearances, but he offers no explanation. Parent† attributes the general retinal shimmer to the reflecting property possessed by the *limitans interna* in young people; with age, he says, its structure changes so as to render it less able to reflect light. The macular ring he considers due to the thinning of the limitans and the scarcity of Müllerian fibres in this locality.

My present object is to draw attention to known anatomical facts which may, I think, assist in explaining these phenomena.

The limitans interna does not by any means present a uniform concave surface, but has often slight, and sometimes considerable irregularities in its curvature. The larger retinal vessels often lie superficially in the nerve-fibre layer, and the limitans interna, instead of stretching straight across, is here elevated by the convexity of the vessel, so that on section we get an appearance such as is diagrammatically represented in Fig. 1.

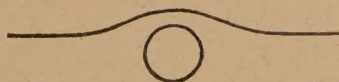


FIG. 1 shows diagrammatically the relation of the limitans interna to a large retinal vessel.

We thus have a projection of the limitans corresponding to the course of the vessel, with a concavity on each side of it. The vessel does not, however, maintain the same uniform level in the retina, but undulates antero-posteriorly, as is often well demonstrated in cases of

* Dr. Rudolf Schirmer. Ueber das Ophthalmoskopische Bild der Macula lutea. Graefe's Archiv f. Ophth., Bd. X, Abth. 1, p. 148 (1864).

† Parent. Étude sur les reflets de la rétine. Recueil d'Ophth., 1880, p. 455.

papillo-retinitis, where the vessel is occluded by the altered nerve-fibre layer when deeply placed, coming again distinctly into view when superficial. Again, in the yellow spot region outside the fovea centralis, the retina is thicker than it is in the perimacular region, so that we have a convexity near the periphery of the macula, with a concavity bounding it externally.

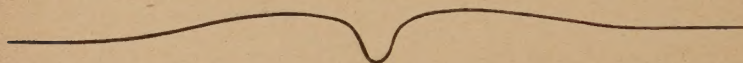


FIG. 2. Diagrammatic section through the fovea centralis and macula.

I would suggest, then, that the light from the mirror falling upon the sloping side of such a convex surface, and meeting it at its "critical angle," undergoes total reflection, and thus illuminates an area of the neighbouring retinal surface. This reflected light is visible to the observer, when it ultimately falls upon a surface so placed that reflection takes place in the direction of and through the pupil of the eye under examination. The changes in the curve of the hyaloid due to the dipping of the vessel previously mentioned would account for the shimmer being occasionally visible over part of the vessel's course.

But, it may be asked, why is the reflex not universal, and when present in youth why does it not persist in later life? It may be that the *limitans interna* varies in reflecting power in different individuals, or in the same individual at different periods of life as Parent suggests, but in the absence of any direct proof of this variability, another explanation may be hazarded. That the appearance is not universal even in the young is probably due to the fact that all such retinæ do not present irregularities of their inner surface sufficient to allow of the reflected rays again becoming visible. The retina, developed from the epiblastic optic vesicle, may often be too large to conform regularly with the inner surface of the mesoblastically formed outer coats, so that unusually great irregularities

will consequently exist on its inner surface.* As the eye grows, however, the incompatibility will gradually become less, and by the time adult age is reached, the retina will be more accurately fitted to its enclosing cup, and the pre-existing irregularities to a large extent flattened down.

The deep concavity at the fovea centralis may similarly account for the bright reflex often obtained there.

I may here observe that during the past year I have in several instances seen a very peculiar foveal reflex in association with myopia. It presents the appearance of a small, fan-shaped, illuminated area, with its apex at the fovea, extending away from it at the side opposite to that from which it is illuminated, so that by minute mirror movements it may be projected on every side of the fovea in turn. The following case is cited in illustration :—

Lilly B., æt. 7. Seen Feb. 2, 1886.

Right. $V. = \frac{2}{24}$ partly; $\bar{c} - 2 D. = \frac{6}{24}$.

Left. $V. = \frac{2}{18}$ partly; $\bar{c} - 2 D. = \frac{6}{18}$.

No higher spherical or any cylindrical glass further improves vision.

Ophth.—Myopia nearly 3 D. Media clear. Fundus normal, except that at the fovea centralis there is a peculiar fan-shaped reflex in front of the retina, reminding one of the appearance produced by a bull's eye lantern shining out into a fog.

In all the cases observed the vision remained defective on full correction of the ametropia. The myopia

* For this suggestion I am indebted to Mr. Nettleship, who has referred me to Ammon's account of the folded condition present in the fetal human retina. The occasional persistence during early life of minor degrees of this folding seems quite plausible in the case of hypermetropic eyes. See Ammon; *Die Entwicklungsgeschichte des Menschlichen Auges*, Berlin, 1858, pp. 97 and 212, and Taf. vii, figs. 5, 6. Ammon also describes the inner aspect of the retina when in this condition as having a mother-of-pearl lustre. He found the folds present from the fourth to the eighth or even ninth month of fetal life.

varied between 3 D. and 17 D. in different cases, but in the higher degrees other myopic changes existed to account for the amblyopia. The ages of the patients observed ranged from 3 to 17 years. The appearance is possibly accounted for by some unusual disposition of the fovea, either in its shape or degree of excavation; or by a localised detachment of the hyaloid membrane with the intervention of a turbid fluid between it and the retina.